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A Materials Survey

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UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

1965

Apparent withdrawals on domestic account ² -----	1, 008, 800	1, 641, 600	1, 608, 000	1, 502, 000	1, 504, 000	1, 415, 000	1, 391, 000		
	1947	1948	1949	1950	1951	1952	1953		
Production from domestic and foreign ores, etc-----	1, 159, 970	1, 107, 446	927, 927	1, 239, 834	1, 206, 988	1, 177, 696	1, 293, 117		
Imports-----	149, 478	249, 124	275, 811	317, 363	238, 972	346, 960	274, 111		
Stocks at beginning of year ¹ -----	96, 000	60, 000	67, 000	61, 000	26, 000	35, 000	26, 000		
Total available supply-----	1, 405, 448	1, 416, 570	1, 270, 738	1, 618, 197	1, 471, 960	1, 559, 656	1, 593, 228		
Copper exported-----	147, 642	142, 598	137, 827	144, 561	133, 305	174, 135	109, 580		
Stocks at end of year ¹ -----	60, 000	67, 000	61, 000	26, 000	35, 000	26, 000	49, 000		
Total-----	207, 642	209, 598	198, 827	170, 561	168, 305	200, 135	158, 580		
Apparent withdrawals on domestic account ² -----	1, 286, 000	1, 214, 000	1, 072, 000	1, 447, 000	1, 304, 000	1, 360, 000	1, 435, 000		
	1954	1955	1956	1957	1958	1959	1960	1961	1962
Production from domestic and foreign ores, etc-----	1, 211, 919	1, 342, 459	1, 442, 633	1, 454, 176	1, 352, 520	1, 098, 247	1, 518, 927	1, 550, 139	1, 611, 730
Imports-----	215, 086	202, 312	191, 745	162, 309	128, 464	214, 058	142, 709	66, 855	98, 820
Stocks at beginning of year ¹ -----	49, 000	25, 000	34, 000	78, 000	109, 000	48, 000	18, 000	99, 000	49, 000
Total available supply-----	1, 476, 005	1, 569, 771	1, 668, 378	1, 694, 485	1, 589, 984	1, 360, 305	1, 679, 636	1, 714, 994	1, 759, 550
Copper exported-----	215, 951	199, 819	223, 103	346, 025	384, 868	158, 938	433, 762	428, 718	336, 525
Stocks at end of year ¹ -----	25, 000	34, 000	78, 000	109, 000	48, 000	18, 000	98, 000	49, 000	71, 000
Total-----	240, 951	233, 819	301, 103	455, 025	432, 868	176, 938	531, 762	477, 718	407, 525
Apparent withdrawals on domestic account ² -----	1, 235, 000	1, 336, 000	1, 367, 000	1, 239, 000	1, 157, 000	1, 183, 000	1, 148, 000	1, 237, 000	1, 352, 000

¹ May include some copper refined from scrap.² Rounded figures.

Beginning in 1945 actual consumption data became available by principal classes of consumers and types of refined copper. These data (table 41) are based on reports from consumers of quantities entering processing but make no adjustment for stock changes of material in process, nor do they distinguish between copper from new and old copper.

Brass mills and wire mills account for most of the consumption of refined copper; from 1945 to 1962 these mills consumed from 94 to

97 percent of the refined copper. In 1945 and 1946 brass mills were the principal users, but from 1947 to 1962, wire mills regularly took 50 percent or more of the total. Brass mill consumption ranged from 36 to 47 percent in the same periods. Of the types of copper consumed, wirebars accounted for more than 50 percent in most years.

Refined-copper consumption fell to a low of 1.13 million tons in 1949 as a result of a general business recession. An upward trend began in

TABLE 41.—*Refined copper consumed, by class of consumers, short tons*

Class of consumer	Billets	Cakes and slabs	Cathodes	Ingots and ingot bars	Wirebars	Other	Total
1945:							
Brass mills.....	108,364	158,061	239,072	219,343	57,949	1,880	784,669
Chemical plants.....	87	4,800	105	215	—	5,111	10,298
Foundries and miscellaneous.....	433	61	11,585	30,405	326	3,197	46,007
Secondary smelters.....	120	101	7,943	10,543	—	9	18,716
Wire mills.....	1	—	14	15,438	504,129	—	519,582
Total.....	108,985	163,023	258,719	275,944	562,404	10,197	1,379,272
1946:							
Brass mills.....	102,804	187,614	97,890	170,772	56,834	1,678	617,592
Chemical plants.....	—	—	60	4,432	—	5,661	10,153
Foundries and miscellaneous.....	645	180	2,263	21,954	225	2,282	27,549
Secondary smelters.....	250	206	17,180	12,705	—	320	30,670
Wire mills.....	—	—	1,803	15,238	484,004	—	501,045
Total.....	103,699	188,000	119,196	226,101	541,063	9,950	1,187,009
1947:							
Brass mills.....	173,124	222,203	68,427	117,936	67,065	4	648,759
Chemical plants.....	—	—	59	251	—	1,662	1,972
Foundries and miscellaneous.....	489	113	1,924	20,299	23	4,128	26,976
Secondary smelters.....	166	279	4,107	3,074	—	197	7,623
Wire mills.....	—	—	2,550	17,633	757,529	62	777,764
Total.....	173,779	222,695	77,067	159,193	824,617	6,043	1,463,294
1948:							
Brass mills.....	169,875	209,861	79,235	92,889	62,454	—	614,314
Chemical plants.....	5	—	45	655	—	2,524	3,229
Foundries and miscellaneous.....	355	67	1,585	23,530	216	4,684	30,387
Secondary smelters.....	178	242	4,847	1,411	—	127	6,805
Wire mills.....	—	—	13	22,390	743,403	43	765,849
Total.....	170,413	210,170	85,725	140,875	806,073	7,238	1,420,584
1949:							
Brass mills.....	123,656	163,982	72,777	72,559	45,033	119	478,126
Chemical plants.....	—	—	19	72	—	1,485	1,576
Foundries and miscellaneous.....	26	80	2,595	14,628	183	4,296	21,808
Secondary smelters.....	65	250	3,127	1,011	—	10	4,463
Wire mills.....	—	—	19	18,230	605,430	34	623,713
Total.....	123,747	164,312	78,537	106,500	650,646	5,944	1,129,686
1950:							
Brass mills.....	160,754	212,353	130,254	104,359	67,379	1	675,100
Chemical plants.....	—	—	17	110	—	2,995	3,122
Foundries and miscellaneous.....	426	70	1,783	18,198	537	5,635	26,649
Secondary smelters.....	—	248	4,584	1,155	192	30	6,209
Wire mills.....	—	6	25	17,453	695,817	53	713,354
Total.....	161,180	212,677	136,663	141,275	763,925	8,714	1,424,434
1951:							
Brass mills.....	135,058	187,041	131,531	124,614	72,415	308	650,967
Chemical plants.....	—	—	—	261	—	2,962	3,223
Foundries and miscellaneous.....	764	302	5,890	22,570	368	8,838	38,732
Secondary smelters.....	4	216	6,953	5,985	375	211	13,744
Wire mills.....	—	152	23	17,311	692,656	57	710,199
Total.....	135,826	187,711	144,397	170,741	765,814	12,376	1,416,865
1952:							
Brass mills.....	134,223	185,138	134,613	163,190	57,456	453	675,073
Chemical plants.....	—	—	—	279	—	3,440	3,719
Foundries and miscellaneous.....	624	161	5,947	23,953	130	7,720	38,535
Secondary smelters.....	—	326	8,819	13,203	8	562	22,918
Wire mills.....	—	209	11	11,977	727,257	33	739,487
Total.....	134,847	185,834	149,390	212,602	784,851	12,208	1,479,732

TABLE 41.—*Refined copper consumed, by class of consumers, short tons—Continued*

Class of consumer	Billets	Cakes and slabs	Cathodes	Ingots and ingot bars	Wirebars	Other	Total
1953:							
Brass mills.....	145,625	188,315	157,735	140,332	57,195	275	689,477
Chemical plants.....				300		3,549	3,849
Foundries and miscellaneous.....	851	227	3,902	19,493	258	7,824	32,555
Secondary smelters.....		114	6,588	8,269		334	15,305
Wire mills.....		120	4,066	16,615	732,228		753,029
Total.....	146,476	188,776	172,291	185,009	789,681	11,982	1,494,215
1954:							
Brass mills.....	155,359	170,144	83,136	82,750	54,237	19	545,645
Chemical plants.....				11		2,318	2,329
Foundries and miscellaneous.....	536	257	1,972	16,683	308	10,964	30,720
Secondary smelters.....		131	5,037	2,064		202	7,434
Wire mills.....			8,803	10,231	649,567		668,601
Total.....	155,895	170,532	98,948	111,739	704,112	13,503	1,254,729
1955:							
Brass mills.....	149,064	200,012	100,819	133,710	63,394	45	647,044
Chemical plants.....				564		1,180	1,744
Foundries and miscellaneous.....	588	321	5,466	17,083	189	10,079	33,726
Secondary smelters.....		469	4,768	1,213		377	6,827
Wire mills.....			9,050	11,797	791,816		812,663
Total.....	149,652	200,802	120,103	164,367	855,399	11,681	1,502,004
1956:							
Brass mills.....	166,426	177,583	91,887	102,451	72,716	35	611,098
Chemical plants.....				559		1,199	1,758
Foundries and miscellaneous.....	775	405	7,004	18,873	161	9,076	36,294
Secondary smelters.....		207	5,602	1,411		434	7,654
Wire mills.....			9,694	16,415	838,476		864,585
Total.....	167,201	178,195	114,187	139,709	911,353	10,744	1,521,389
1957:							
Brass mills.....	156,292	158,344	85,833	76,046	57,399	40	533,954
Chemical plants.....				708		772	1,480
Foundries and miscellaneous.....	689	205	6,023	18,369	968	8,933	35,182
Secondary smelters.....		212	5,197	1,839		628	7,876
Wire mills.....			5,641	15,406	751,815	770	773,632
Total.....	156,981	158,761	102,694	112,368	810,177	11,143	1,352,124
1958:							
Brass mills.....	150,160	116,659	91,192	74,098	47,354	47	479,510
Chemical plants.....				407		490	897
Foundries and miscellaneous.....	702	126	4,064	10,743	453	6,730	22,818
Secondary smelters.....		219	4,080	2,485		398	7,182
Wire mills.....			4,394	11,464	723,450	962	740,270
Total.....	150,862	117,004	103,730	99,197	771,257	8,627	1,250,677
1959:							
Brass mills.....	170,074	146,852	86,648	116,190	64,277	59	584,100
Chemical plants.....				310		484	794
Foundries and miscellaneous.....	511	23	6,175	15,529	222	11,389	33,849
Secondary smelters.....		246	5,320	2,079		466	8,111
Wire mills.....			6,432	11,790	817,030	925	836,177
Total.....	170,585	147,121	104,575	145,898	881,529	13,323	1,463,031
1960:							
Brass mills.....	144,725	137,667	74,993	80,247	48,776	52	488,460
Chemical plants.....				465		571	1,036
Foundries and miscellaneous.....	833	32	5,864	12,552	97	5,993	25,371
Secondary smelters.....		177	5,939	1,913		177	8,206
Wire mills.....			3,928	13,450	810,670	875	828,823
Total.....	145,558	137,876	90,724	108,627	859,443	7,668	1,349,896
1961:							
Brass mills.....	189,333	152,876	119,172	95,943	42,391	50	599,765
Chemical plants.....				720		549	1,269
Foundries and miscellaneous.....	1,225	25	8,689	13,258	96	5,200	28,493
Secondary smelters.....		172	6,782	2,390		160	9,504
Wire mills.....			604	10,356	812,065	774	823,799
Total.....	190,558	153,073	135,247	122,667	854,552	6,733	1,462,830
1962:							
Brass mills.....	198,676	184,085	113,402	97,090	42,799	97	636,149
Chemical plants.....				761		727	1,488
Foundries and miscellaneous.....	929	54	6,826	15,676	42	6,144	29,671
Secondary smelters.....		159	7,368	1,928		5	9,460
Wire mills.....				8,964	913,131	813	922,908
Total.....	199,605	184,296	127,596	124,419	955,972	7,786	1,599,676

TABLE 42.—Consumption of purchased copper-base scrap, gross weight in short tons

	1940	1941	1942	1943	1944	1945	1946		
Brass mills.....	(1)	314, 140	547, 195	609, 589	611, 661	596, 361	401, 420		
Foundries, chemical plants, and miscellaneous manufacturers.....	333, 529	170, 469	136, 522	133, 298	168, 326	159, 412	158, 354		
Primary copper producers.....	² 374, 395	² 519, 561	² 625, 065	² 790, 936	² 727, 873	² 714, 964	² 609, 366		
Secondary smelters.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)		
Total.....	707, 924	1, 004, 170	1, 308, 782	1, 533, 823	1, 407, 860	1, 470, 737	1, 169, 140		
	1947	1948	1949	1950	1951	1952	1953		
Brass mills.....	391, 187	425, 524	275, 559	446, 987	448, 501	516, 811	499, 655		
Foundries, chemical plants, and miscellaneous manufacturers.....	171, 102	169, 438	131, 093	161, 861	173, 218	151, 599	171, 695		
Primary copper producers.....	² 911, 607	² 800, 679	² 415, 498	² 385, 660	² 241, 514	² 229, 455	² 327, 640		
Secondary smelters.....	(2)	393, 717	273, 988	446, 664	458, 306	400, 439	386, 899		
Total.....	1, 473, 896	1, 489, 358	1, 096, 138	1, 441, 172	1, 321, 539	1, 289, 304	1, 385, 889		
	1954	1955	1956	1957	1958	1959	1960	1961	1962
Brass mills.....	399, 759	477, 180	388, 738	335, 148	324, 280	430, 711	355, 487	347, 840	419, 925
Foundries, chemical plants, and miscellaneous manufacturers.....	129, 292	146, 629	147, 215	120, 327	108, 174	130, 293	116, 687	103, 952	101, 047
Primary copper producers.....	326, 575	318, 269	370, 946	348, 184	325, 594	327, 206	400, 781	390, 043	400, 425
Secondary smelters.....	373, 471	412, 944	384, 780	353, 464	351, 431	379, 706	335, 479	328, 262	343, 904
Total.....	1, 229, 097	1, 355, 022	1, 291, 679	1, 157, 123	1, 109, 479	1, 267, 916	1, 208, 434	1, 170, 097	1, 265, 301

¹ Not separately available.² Includes remelters, smelters, and refiners.³ Included with primary copper producers.

1950, owing largely to expanded defense activities because of the Korean war, and consumption averaged 1.5 million tons for 1950-53. Use declined to 1.3 million in 1954 owing to the inadequate supply situation that developed in the latter half of the year because of labor strikes at some copper-producing properties. After the strikes ended the Office of Defense Mobilization authorized release of copper accumulated under the Defense Production Act to help relieve the situation.

Consumption rose substantially in the next two years, exceeding 1.5 million tons in each year. The economic downturn in 1957 affected important consumers of copper products, and consumption of refined copper declined 11 percent. Consumption moved upward from the second half of 1958 through mid-1959, and in 1959 exceeded 1958 by 17 percent. It dropped 8 percent in 1960, but rose to 1.6 million tons in 1962.

In addition to refined copper, consumers use substantial quantities of copper-base scrap in their manufacturing operations. Data for consumption of purchased copper scrap (table 42) also reflect periods of industrial expansion, war requirements, and economic declines.

Foreign Countries

Outside the United States, the principal copper consuming countries are the United Kingdom, Germany, France, Italy, Japan, and the U.S.S.R. Germany was second to the United States until 1935, when it was displaced by the United Kingdom; it regained this position in

1938, fell to third place in 1954, and fluctuated between second and third positions thereafter.

In Germany the copper industry was revived in 1934, as the demand for copper rose 30 percent. Domestic mines supplied about 10 percent of requirements, and large imports of raw materials were needed. Reduced consumption in 1935 and 1936 reflected the substitution of aluminum and iron alloys and restriction in the use of copper for necessities. Following the end of World War II, data are shown for West Germany. Except for 1949-52, smelter production was inadequate to meet expanding requirements, and the deficits were met by imports.

The United Kingdom has ranked second among copper-consuming countries continuously since 1946. At the beginning of World War II adequate copper from Rhodesia and Canada was available for all emergencies in the United Kingdom, and the only problems with supply revolved around ocean transportation and electrolytic refining. Consumption rose to 335,000 tons in 1937. At the beginning of 1945 the United Kingdom discontinued purchases of copper, and contracts with Rhodesian and Canadian producers were terminated in an effort to reduce large stocks on hand. At that time, Rhodesian copper was released to the United States under reverse Lend-Lease arrangements. By the end of 1945, however, the United Kingdom had to buy large quantities of copper again. New contracts were made with Rhodesian and Canadian producers, and even some Chilean copper was purchased. Consumption continued upward until 1949. The quantity used in 1953 was the smallest in more

TABLE 43.—*Consumption of copper in the United Kingdom, short tons*

	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Refined copper: ¹												
Virgin.....	370,000	389,000	273,000	401,000	445,000	449,000	469,000	498,000	444,000	506,000	477,900	474,000
Secondary.....	247,000	84,000	88,000	90,000	111,000	113,000	99,000	101,000	92,000	111,000	105,000	105,900
Copper in scrap ²	247,000	187,000	140,000	152,000	183,000	147,000	150,000	149,000	173,000	192,000	180,400	147,300
Total.....	617,000	640,000	501,000	643,000	739,000	709,000	718,000	748,000	709,000	809,000	763,300	727,200
Consumed in semimanufactured products:												
Refined copper.....	358,000	451,000	346,000	474,000	537,000	542,000	548,000	578,000	517,000	594,000	561,000	560,300
Copper in scrap.....	179,000	107,000	91,000	93,000	118,000	75,000	80,000	87,000	107,000	119,000	110,000	83,700
Consumed in castings, sulfate, and miscellaneous products:												
Refined copper.....	12,000	22,000	15,000	17,000	19,000	20,000	20,000	20,000	19,000	23,000	21,900	19,500
Copper in scrap.....	88,000	60,000	49,000	59,000	65,000	72,000	70,000	63,000	66,000	73,000	70,400	63,700

¹ Consumption of refined copper (virgin and secondary) is as reported by consumers. Virgin copper represents copper refined in the United Kingdom from ores and from imported blister together with copper imported as refined. Insofar as imported refined copper may have originated from secondary material this is included in the statistics as virgin. Secondary refined copper represents copper refined in the United Kingdom from scrap and other secondary material.

² Consumption of copper in scrap is obtained by difference between copper content of output and consumption of refined copper, and should be considered over a period, since monthly figures of scrap consumption are affected by variations in the amount of work in progress.

³ Virgin copper only.

⁴ Includes secondary refined copper.

Source: World Non-Ferrous Metal Statistics Bulletins.

TABLE 44.—*Use of copper in Japan, thousands of short tons*

	1954	1955	1956	1957	1958
Copper castings, etc.:					
Electrolytic copper.....	7	7	11	11	9
Scrap.....	11	11	20	27	27
Total.....	18	18	31	38	36
Copper rolling products:					
Electrolytic copper.....	23	31	48	47	51
Scrap.....	70	71	94	94	93
Total.....	93	102	142	141	144
Electric wire and cable:					
Electrolytic copper.....	74	84	127	105	120
Scrap.....	13	21	26	31	23
Total.....	87	105	153	136	143
Grand total.....	198	225	326	315	323

Source: Prepared from the Review of Nonferrous Metal Industry reprinted in Survey of Japanese Finance & Industry, The Industrial

Bank of Japan, vol. 12, No. 3, May-June 1960, 17 pp.

than a decade; it rose 39 percent in 1954 and increased each year thereafter until 1959. Data showing consumption of refined copper and scrap are shown in table 43.

Other important consumers of copper in Europe are France and Italy. In both countries consumption has advanced steadily.

Consumption of copper in Japan averaged about 80,000 tons a year until 1934 when it rose to 37 percent more than 1933. To meet the greatly expanded demand for copper, Japan began importing foreign materials in 1934. In the years for which data are available, consumption reached a high of 221,000 tons in 1938. Following the end of World War II, consumption fell below prewar levels;

then, an upward trend began in 1951. Scrap which had been collected from war-damaged areas constituted the major source of supply. Imports of raw material became large again in 1956, and consumption attained a peak of 335,000 tons in 1960. Table 44 shows use of copper for 1954-58.

WORLD TRADE

The United States is the leading country in world trade of copper. Crude materials, such as ores, concentrates, matte, and blister are imported, as well as refined copper. Fabricated copper, fabricated-copper products, manufactured goods containing copper, and refined

copper are exported. The other leading producing countries—Canada, Chile, Republic of the Congo, Federation of Rhodesia and Nyasaland—export most of their output. Approximately 125,000 tons of the annual output of Canada is consumed in that country. The United Kingdom regularly imports most of its requirements.

United States

For many years before World War II, U.S. production of copper exceeded supply, and there was a substantial surplus for export. After the beginning of the war the United States needed all the copper that entered the country to fill its large armament requirements and in 1940 again became a net importer of copper. The high level of industrial activity for most of the postwar period continued to require large importations of raw materials. Also, domestic production was adversely affected by labor strikes. The record for imports was reached in 1945 when receipts of unmanufactured copper totaled 853,000 tons. Again in June 1950 the conflict in Korea made it necessary to import large quantities of copper. About one-fourth of U.S. requirements have been met by imports. For the first time in 20 years exports exceeded imports in 1960.

After enactment of the excise tax law in 1932, copper that was imported in bond for smelting and/or refining and subsequent export was tax free; only small quantities of refined copper were received. This situation changed in 1941. It became evident that domestic metal would be inadequate to fill U.S. requirements plus sharply expanded demands of foreign countries for war products made with copper. Every effort was made to supply adequate shipping facilities to obtain all available refined copper, and this class became the principal import item. Receipt of 531,000 tons of refined copper in 1945 was a record. Imports fell sharply thereafter but an upward trend began in 1950 with conflict in Korea. A postwar high of 347,000 tons was attained in 1952 as a result of diversion of Canadian copper from a strike-bound refinery in Canada and greater receipts from Chile. The latter was due to action of the U.S. Government, which permitted passing on increased costs of foreign copper to consumers. See the section about legislation and government programs.

Virtually all copper exported is refined copper and fabrications therefrom. Refined copper was the largest export class until 1944 when insulated wire and cable became the principal class. Before World War II, exports went largely to Japan and certain European

countries—Belgium, France, Germany, Italy, Sweden, and the United Kingdom. After the war began only the United Kingdom was an important customer until it was joined by the U.S.S.R. Exports fell sharply during the war years and continued far below prewar levels in many years after the war. Because the supply of copper in the United States was inadequate to fill requirements in most of this period, copper was subject to export controls. In September 1956 export restrictions were removed and shipments rose to the highest level since 1940. In 1959 a shortage developed because of strikes, and exports fell to less than half the 1958 shipments. A sharp increase was recorded in 1960 as West Germany, United Kingdom, Italy, and France took 73 percent of the total. Significant quantities went to Japan, Brazil, and Argentina.

Imports.—The longtime copper position of the United States was that of an exporting nation until World War II. U.S. smelting and refining capacity was excessive for treatment of domestic materials, and this excess capacity encouraged importation of foreign crude materials for custom treatment. Most of the imported materials were smelted and refined under bond for reexportation in refined or manufactured forms. In addition, much domestic copper was shipped for consumption abroad. In 1930, however, because of sharply reduced world consumption, the situation reversed, and the United States became a net importer. In 1932 to discourage receipts of foreign copper an excise tax was imposed, and in 1933 the United States resumed its net export position which held through 1939. After the start of World War II in Europe and the stepup of armament requirements there and elsewhere, the United States became a net importer of copper.

Four countries in the Western Hemisphere have supplied almost 80 percent of the total imports in the last 35 years. Chile ranked first with 46 percent of the total, followed by Canada, 14 percent; Mexico, 11 percent; and Peru, 8 percent. Republic of the Congo and the Federation of Rhodesia and Nyasaland each accounted for 4 percent.

By 1933 imports had decreased to 144,000 tons—a record low—partly as a result of the imposition of the 4-cent excise tax in 1932. As business conditions improved in 1934 imports increased despite the duty. Greater receipts of unrefined classes more than offset the drop in refined copper and were largely responsible for the increased imports. Except for 1929, requirements for copper outside the United States in 1936 were the largest on record, and U.S. imports fell to 190,000 tons. From 1939

to 1945 imports rose substantially; the duty did not apply in this period because the Government was purchasing all the copper brought into the United States. Requirements were drastically reduced after the war ended in 1945, and imports fell to 396,000 tons. Imports trended upward from 1947 to 1950 and almost reached wartime levels as 690,000 tons entered the United States in 1950. The large increase was due to anticipated defense requirements after the outbreak of hostilities in Korea in June 1950.

The continuing shortage of domestic supplies resulted in large quantities of foreign materials in 1952 and 1953. Imports fell 12 percent in 1954 and remained at approximately the 1954 level, except for 1958 through 1962.

For a number of years before 1940, entries of refined copper were no more than 5 percent of the imports; in 1941 the refined class accounted for 47 percent of the total. This was due to the unprecedented requirements for copper in the United States and to the disrupted state of ocean transportation; both factors caused metal that normally would have gone to Europe to be shipped to the United States. In the next 4 years (1942-45) refined copper receipts exceeded imports of all unrefined classes. Thereafter, except for 1948, 1949, and 1952, the unrefined classes accounted for most of the imports. Between 1926 and 1962, imports of the unrefined classes accounted for 63 percent of the total; refined classes, 36 percent; and scrap, 1 percent.

Chile supplied virtually all the refined copper from 1926-44, except for 1931 and 1932 when Canada furnished almost 50 percent. In mid-1944 with the United Kingdom in a more abundant supply position, increased quantities of refined metal began to come from Canada, and in 1945 important quantities came from Belgian Congo and Northern Rhodesia. More than 50 percent of the refined metal continued to come from Chile until 1955 when it accounted for only 33 percent of the total and was displaced by Canada. Since then, most of the copper from Chile has been shipped to European countries, and Canada has continued as the chief supplier of refined metal to the United States.

Of the unrefined classes, blister copper has been the principal class, accounting for 45 percent of the total receipts in 35 years. Record receipts were established in 1929. Western Hemisphere countries supplied most of the blister copper; Mexico and Peru outranked Chile as a supplier in 1926-28; Chile was first in 1929, dropped to fourth place in 1930, ranked first from 1935-46, fell to second in 1946, and rose

to first in 1948—a position that it has held ever since. The large receipts from Belgian Congo in World War II years were destined largely for the United Kingdom after refining. Peru dropped from the list of principal sources in 1949 but rose to second place in 1960, becoming a major supplier from the newly opened Toquepala unit of Southern Peru Copper Corp. Canada was a major source until 1944, and Rhodesia began sending important quantities in 1950.

Ore and concentrate account for 16 percent of the total foreign materials with the concentrate class the largest—13 percent of the total. Canada has been the principal source of this material, followed by Chile and Cuba. Substantial quantities have been furnished by the Philippines since 1950. Other important suppliers are Mexico and the Republic of South Africa.

Imports of scrap copper are usually negligible and have ranged from less than 200 tons to 13,000 tons. In 1950, however, scrap totaled 39,000 tons, because unusually large tonnages were received from Japan—26,000 tons.

Data on United States imports are given in tables 45-48.

Exports.—Most copper exported is in advanced forms of manufacture, and the copper content cannot be measured. From before 1900 to 1944 refined copper was the principal export class by a substantial margin until it was displaced by the wire class in 1944. The sharp gains in exports of insulated wire and cable furnished a guide to either the war contestants or to the war areas. The principal destinations of this class of exports are shown in table 49 for 1939-48.

U.S. exports of refined copper through 1929 reflected the expanded business activity in the late 1920's. Shipments reached a high of 475,000 tons in 1928, only 8 percent below the record of 515,000 tons in 1917. Germany, the United Kingdom, and France received 59 percent of the total. Exports fell rapidly during the depression; shipments dropped to 111,000 tons in 1932. The principal destination was the United Kingdom; France and Germany were next. In 1933 the copper industry began to recover from the depression and exports rose 12 percent above 1932. In the following years exports increased substantially; refined copper shipments averaged 282,000 tons annually from 1934-38. During this period Japan was the chief recipient, followed by the United Kingdom, Germany, and France. The prewar peak was reached in 1939 when shipments to foreign consumers totaled 373,000 tons. Japan continued to be the largest importer, followed by France, Italy, and Sweden.

TABLE 45.—Copper (unmanufactured) imported into the United States in terms of copper content,¹ short tons

Year	Ore	Concen- trate	Matte	Blister	Refined	Scrap	Total
1926	53,358	22,375	1,065	221,899	85,283	5,501	389,481
1927	49,664	34,096	697	219,297	51,640	3,739	359,133
1928	53,096	19,736	1,320	271,595	42,365	5,316	393,428
1929	62,310	26,864	1,052	323,084	67,007	6,799	487,116
1930	50,658	28,435	2,353	280,235	43,105	3,750	408,536
1931	11,790	49,704	735	140,925	87,225	2,550	292,929
1932	7,007	22,097	866	80,844	83,897	1,265	195,976
1933	6,226	18,916	1,222	111,791	5,432	130	143,717
1934	6,278	23,262	1,870	154,234	27,417	225	213,286
1935	7,660	30,198	2,733	197,975	18,071	545	257,182
1936	13,004	30,969	1,838	138,136	4,782	1,609	190,338
1937	16,148	51,828	5,185	195,884	7,487	3,342	279,874
1938	7,480	62,252	2,519	176,798	1,802	1,313	252,164
1939	6,168	62,161	2,828	245,130	16,264	3,746	336,297
1940	11,293	71,574	60,115	278,212	68,337	1,811	491,342
1941	4,562	76,539	47,958	257,206	346,994	2,286	735,545
1942	5,527	65,188	68,566	222,619	401,436	1,057	764,393
1943	7,784	60,722	56,619	186,380	402,762	2,387	716,654
1944	6,415	59,054	50,857	175,424	492,395	1,066	785,211
1945	8,858	48,632	19,862	243,101	531,367	1,376	853,196
1946	4,895	41,844	777	193,387	154,371	1,106	396,380
1947	14,665	71,193	5,223	167,378	149,482	5,953	413,894
1948	8,197	81,301	3,657	155,836	249,124	9,334	507,449
1949	6,818	108,814	2,084	152,376	275,811	6,801	552,704
1950	2,600	104,168	3,233	224,222	317,363	38,803	690,389
1951	2,035	97,591	3,051	141,922	238,972	5,564	489,135
1952	3,198	98,143	3,900	162,193	346,960	4,486	618,880
1953	6,997	106,574	7,019	273,610	274,111	7,793	676,104
1954	5,343	107,438	5,795	256,484	215,086	4,683	594,829
1955	8,132	109,497	7,898	253,693	202,312	12,568	594,100
1956	17,459	97,404	7,311	276,085	191,745	5,743	595,747
1957	18,838	99,755	6,196	301,136	162,309	5,798	594,032
1958	8,217	79,200	5,178	268,182	128,464	7,060	496,301
1959	7,330	65,311	8,949	269,048	214,058	6,195	570,891
1960	9,982	65,536	5,049	298,373	142,709	2,695	524,344
1961	8,937	36,851	1,606	339,189	66,855	4,231	457,669
1962	4,897	38,020	635	331,686	98,820	4,793	478,851

¹ Data are general imports; that is, they include copper imported for immediate consumption plus material entering the country under bond.

Source: U.S. Department of Commerce.

TABLE 46.—Copper (unmanufactured) imported into the United States, by class and country in terms of copper content,¹ short tons

	1926	1927	1928	1929	1930	1931	1932
Ore and concentrate:							
Australia	124	154	158	93	292		(²)
Bolivia	12	21	5	3	60	78	(²)
Canada	27,787	25,517	24,563	30,339	28,135	16,935	9,204
Chile	16,982	20,368	17,302	20,803	14,792	9,241	7,872
Cuba	9,953	14,686	7,089	5,075	13,005	10,498	5,048
France	592	106	202	593	668	129	23
West Germany	366	229	190	1,536	865	507	
Malta, Gozo, Cyprus		71					
Mexico	10,842	15,969	17,026	15,679	13,108	11,533	515
Northern Rhodesia							
Peru	712	1,004	463	3,528	720	836	796
Philippines			388	105	111	639	1,041
Republic of South Africa			4,557	7,317	4,862	12	5
Spain	6,740	4,232	889	4,103	2,476	11,086	4,699
Other	1,643	1,373					
Total	75,733	83,760	72,832	89,174	79,093	61,494	29,104
Matte and blister:							
Australia	70		27		1,765	2,424	1,195
Republic of the Congo		57,241	57,000	27,664	36,031		
Canada	22,535	25,740	47,841	66,369	74,667	19,646	10,708
Chile	15,784	31,856	47,890	82,135	39,554	30,812	1,578
France	587	62	47	1,659	980	28	65
West Germany	108	34	85	3,610	3,229	34	111
Mexico	41,646	42,098	49,114	69,532	59,514	43,579	36,569
Northern Rhodesia							
Peru	47,004	50,978	57,823	58,923	55,356	43,708	22,422
Republic of South Africa		1,349	1,434		7	60	3,133
Spain	12,392		140	1,123	1,017	72	32
Turkey							
United Kingdom	13,997	9,762	1,834	7,218	1,799	14	68
Yugoslavia							
Other	68,841	874	9,680	5,832	8,669	1,283	5,769
Total	222,964	219,994	272,915	324,136	282,588	14,1660	81,710
Refined:							
Republic of the Congo							
Belgium-Luxembourg	221						
Canada	1	413	75	340	3,133	41,845	38,005
Chile	83,436	50,420	41,867	66,641	39,972	45,247	45,270
West Germany	30	279	385	116			
Japan							
Malta, Gozo, Cyprus							
Mexico	105						620
Northern Rhodesia							
Peru						132	
Republic of South Africa		(²)					
Sweden							
United Kingdom	1,035	505				1	(²)
Yugoslavia							
Other	455	23	38	10			2
Total	85,283	51,640	42,365	67,007	43,105	87,225	83,897
Scrap:							
Canada	3,006	2,829	3,946	5,702	2,900	2,013	1,057
Chile	172	136	8	7		15	10
Cuba	963	314	275	546	317	71	57
United Kingdom	445	36	692	5	11	16	37
Other	915	424	395	539	522	435	104
Total	5,501	3,739	5,316	6,799	3,750	2,550	1,265

See footnotes at end of table.

TABLE 46.—Copper (unmanufactured) imported into the United States, by class and country in terms of copper content,¹ short tons—Continued

	1933	1934	1935	1936	1937	1938	1939
Ore and concentrate:							
Australia.....	179	524	1,324	858	2,478	2,109	2,721
Bolivia.....	267			2,283	2,840	2,616	2,113
Canada.....	6,187	8,158	8,455	12,314	29,232	31,917	37,067
Chile.....	9,192	11,382	7,609	7,296	8,764	4,562	5,230
Cuba.....	8,413	7,975	5,816	11,784	14,069	17,320	9,863
France.....	2				(2)		34
West Germany.....							
Malta, Gozo, Cyprus.....				1,298	4,361	1,429	1,625
Mexico.....	121	288	980	1,598	2,976	6,736	5,838
Northern Rhodesia.....							
Peru.....	248	265	981	527	809	909	726
Philippines.....				171	360	1,160	1,518
Republic of South Africa.....		14		44	82	262	192
Spain.....					3	1	
Other.....	533	934	12,693	5,800	2,002	711	1,402
Total.....	25,142	29,540	37,858	43,973	67,976	69,732	68,329
Matte and blister:							
Australia.....	3	35	30	8	26	356	290
Republic of the Congo.....							
Canada.....	10,618	13,821	35,661	1,311	7,753	17,985	17,438
Chile.....	13,411	36,139	57,600	47,353	82,225	61,076	98,846
France.....	88	166	546	140	150	136	399
West Germany.....	80	267	232		50		
Mexico.....	43,082	51,942	45,907	33,380	50,822	40,406	46,682
Northern Rhodesia.....							
Peru.....	25,917	29,513	36,266	34,673	40,136	39,216	37,766
Republic of South Africa.....	1,485		250	11	608	1,659	16,809
Spain.....	81	13	55	27		1	19
Turkey.....						2,544	5,035
United Kingdom.....	93	50	606	568	719	251	276
Yugoslavia.....	4,429	10,351	21,681	19,033	16,124	10,582	9,527
Other.....	13,726	13,807	1,874	3,470	2,456	5,105	14,871
Total.....	113,013	156,104	200,708	139,974	201,069	179,317	247,958
Refined:							
Republic of the Congo.....							
Belgium-Luxembourg.....							
Canada.....		(2)	(2)	1	1	16	420
Chile.....	5,431	26,241	18,071	4,556	7,482	1,786	15,844
West Germany.....		(2)					
Japan.....							
Malta, Gozo, Cyprus.....							
Mexico.....		1,175					
Northern Rhodesia.....							
Peru.....				224			
Republic of South Africa.....							
Sweden.....				(2)			
United Kingdom.....	1	1	(2)	1	4	(2)	(2)
Yugoslavia.....							
Other.....				(2)	(2)		
Total.....	5,432	27,417	18,071	4,782	7,487	1,802	16,264
Scrap:							
Canada.....	130	139	327	1,048	1,552	533	2,575
Chile.....		12	9	176	1,047	310	
Cuba.....		1		40	127	159	34
United Kingdom.....	(2)			3	79	12	357
Other.....		73	209	342	537	299	780
Total.....	130	225	545	1,609	3,342	1,313	3,746

See footnotes at end of table.

TABLE 46.—Copper (unmanufactured) imported into the United States, by class and country in terms of copper content,¹ short tons—Continued

	1940	1941	1942	1943	1944	1945	1946
Ore and concentrate:							
Australia.....	926	1, 150	3, 431	679	419	102	8
Bolivia.....	4, 104	6, 456	5, 379	6, 300	3, 784	4, 929	4, 573
Canada.....	35, 582	40, 466	31, 577	27, 886	25, 912	17, 580	12, 597
Chile.....	6, 994	2, 811	7, 195	8, 816	8, 595	12, 375	4, 308
Cuba.....	11, 560	8, 067	8, 867	7, 758	7, 123	9, 422	12, 378
France.....							
West Germany.....							
Malta, Gozo, Cyprus.....	4, 652			2, 762	3, 925		
Mexico.....	7, 787	8, 272	5, 747	6, 425	8, 695	7, 720	8, 322
Northern Rhodesia.....			321	147	156	414	260
Peru.....	3, 656	5, 269	6, 017	4, 244	5, 804	4, 778	3, 830
Philippines.....	2, 086	3, 964	256				
Republic of South Africa.....	2, 762	193	16	3, 283	1, 030	150	137
Spain.....	14						
Other.....	2, 744	4, 453	1, 909	206	26	20	326
Total.....	82, 867	81, 101	7, 715	68, 506	65, 469	57, 490	46, 739
Matte and blister:							
Australia.....	113	1	182			909	
Republic of the Congo.....	60, 515	81, 956	89, 050	72, 490	63, 404	47, 842	4, 469
Canada.....	23, 244	22, 833	6, 106	6, 353	342	456	207
Chile.....	131, 673	114, 432	92, 247	83, 355	89, 797	54, 855	66, 868
France.....	169						
West Germany.....							
Mexico.....	35, 604	46, 136	51, 657	44, 844	37, 503	58, 849	56, 362
Northern Rhodesia.....			4, 224	10	1	64, 382	11, 682
Peru.....	38, 221	30, 882	24, 592	27, 326	28, 261	25, 905	26, 544
Republic of South Africa.....	12, 959	59	17, 889	598	13	6, 133	4, 361
Spain.....	136	3					
Turkey.....	6, 224			2, 342	2, 766		17, 414
United Kingdom.....	21		3, 258				3, 323
Yugoslavia.....							
Other.....	29, 148	8, 862	2, 000	5, 681	4, 214	3, 632	2, 934
Total.....	338, 327	305, 164	291, 185	242, 990	226, 281	262, 963	194, 164
Refined:							
Republic of the Congo.....				4, 405		41, 782	
Belgium-Luxembourg.....							
Canada.....	1, 673	3, 912	820	323	41, 323	76, 392	17, 193
Chile.....	66, 664	343, 082	400, 616	396, 362	450, 610	384, 843	136, 312
West Germany.....							
Japan.....							
Malta, Gozo, Cyprus.....							
Mexico.....						44	
Northern Rhodesia.....						25, 166	
Peru.....				1, 672	462	692	
Republic of South Africa.....						783	866
Sweden.....							
United Kingdom.....							
Yugoslavia.....			(?)	(?)		1, 665	
Other.....							
Total.....	68, 337	346, 994	401, 436	402, 762	492, 395	531, 367	154, 371
Scrap:							
Canada.....	1, 062	1, 892	568	476	502	1, 186	542
Chile.....	2	45		1, 323			37
Cuba.....			227	127			
United Kingdom.....	8	19	2				63
Other.....	739	330	260	461	564	190	464
Total.....	1, 811	2, 286	1, 057	2, 387	1, 066	1, 376	1, 106

See footnotes at end of table.

TABLE 46.—Copper (unmanufactured) imported into the United States, by class and country in terms of copper content,¹ short tons—Continued

	1947	1948	1949	1950	1951	1952	1953
Ore and concentrate:							
Australia.....	322	769	939	669	717	684	1,044
Bolivia.....	6,762	6,729	4,667	5,266	4,449	3,091	3,955
Canada.....	22,419	24,426	31,488	24,503	24,743	26,570	31,455
Chile.....	19,658	19,532	22,799	13,361	12,067	11,863	15,761
Cuba.....	14,898	16,254	15,606	22,429	21,895	18,921	17,757
France.....		103	139				
West Germany.....							
Malta, Gozo, Cyprus.....		2,689	6,888	6,530	5,555	5,441	3,680
Mexico.....	9,605	8,473	11,438	9,189	6,425	6,470	9,003
Northern Rhodesia.....	101	131	108	233	98	167	212
Peru.....	7,713	5,013	6,708	7,315	7,351	8,859	9,498
Philippines.....	2,130	2,252	7,910	10,004	12,808	14,787	13,538
Republic of South Africa.....	1,728	2,430	6,037	6,511	3,626	5,251	7,412
Spain.....							
Other.....	537	698	906	795	61	247	256
Total.....	85,858	89,498	115,632	106,768	99,626	101,341	113,571
Matte and blister:							
Australia.....							9,414
Republic of the Congo.....							5,282
Canada.....	2,154	933	547	980	793	27,274	117,520
Chile.....	60,206	70,893	51,969	64,951	47,186	56,025	
France.....			19	126			
West Germany.....							
Mexico.....	66,173	48,136	51,792	48,746	40,602	38,686	49,292
Northern Rhodesia.....		18,930	27,123	37,062	43,717	28,224	85,264
Peru.....	22,884	14,072	847	6,756	2,325	796	866
Republic of South Africa.....	7,932	3,353	2,778	3,286	3,719	3,326	166
Spain.....							
Turkey.....	1,933		4,572	3,266		3,779	11,894
United Kingdom.....				44			382
Yugoslavia.....	10,145	2,298	14,727	10,885	6,223	8,023	
Other.....	1,154	888	86	1,253	498	10	570
Total.....	172,601	159,493	154,400	227,455	144,973	166,093	280,629
Refined:							
Republic of the Congo.....							5,799
Belgium-Luxembourg.....						646	5,540
Canada.....	1,180	17,127	47,930	52,099	28,354	28,326	67,487
Chile.....	143,010	230,288	210,443	213,754	208,444	294,425	147,294
West Germany.....						8,932	3,670
Japan.....	3,226		1,112	27,590	852	223	
Malta, Gozo, Cyprus.....							
Mexico.....	66	947	1,468	4,782	737	5,839	7,513
Northern Rhodesia.....						1	2,778
Peru.....	2,000	233	14,756	14,428	377	1,662	16,157
Republic of South Africa.....							100
Sweden.....							1,603
United Kingdom.....		113	36	232	6	37	1,396
Yugoslavia.....						6,810	7,775
Other.....		416	66	4,478	182	59	7,099
Total.....	149,482	249,124	275,811	317,363	238,972	346,960	274,111
Scrap:							
Canada.....	4,693	4,782	2,856	4,783	664	762	3,223
Chile.....	250		175	159	633		499
Cuba.....	55	16	244	462	407	1,013	449
United Kingdom.....	(a)	882	1,887	684		(a)	416
Other.....	956	3,654	1,639	32,735	3,860	2,711	3,206
Total.....	5,953	9,334	6,801	38,803	5,564	4,486	7,793

See footnotes at end of table.

TABLE 46.—Copper (unmanufactured) imported into the United States, by class and country in terms of copper content,¹ short tons—Continued

	1954	1955	1956	1957	1958	1959	1960	1961	1962
Ore and concentrate:									
Australia.....	1,183	1,152	1,022	773	629	3,051	773	793	751
Bolivia.....	3,901	3,292	4,483	4,450	3,395	—	1,345	905	1,590
Canada.....	30,252	26,344	23,149	28,470	6,627	5,636	14,381	13,959	18,028
Chile.....	12,547	21,436	18,711	17,287	16,381	15,969	14,192	1,992	22
Cuba.....	17,698	20,356	15,394	16,550	13,992	9,942	6,554	—	—
France.....	—	—	—	—	—	—	—	—	—
West Germany.....	—	—	—	—	—	—	—	—	—
Malta, Gozo, Cyprus.....	—	4,388	6,945	8,937	6,384	3,524	—	—	—
Mexico.....	11,644	8,079	6,929	3,787	2,958	454	107	158	244
Northern Rhodesia.....	256	262	244	75	336	—	—	—	—
Peru.....	8,563	8,707	11,372	11,673	8,852	7,538	8,008	6,793	6,416
Philippines.....	19,405	13,321	10,907	13,060	14,519	12,882	17,553	13,891	10,125
Republic of South Africa.....	7,393	10,269	15,228	13,081	12,918	11,687	12,588	7,275	5,751
Spain.....	—	—	—	—	—	—	—	—	—
Other.....	39	23	479	150	434	1,958	16	22	—
Total.....	112,781	117,629	114,863	118,593	87,425	72,641	75,518	45,788	42,917
Matte and blister:									
Australia.....	15,499	10,144	17,437	14,302	4,438	4,421	—	33	—
Republic of the Congo.....	8,045	9,231	4,345	—	—	—	—	—	—
Canada.....	6,499	1,348	2,619	1,070	1,248	1,075	902	571	201
Chile.....	128,550	138,050	175,889	208,539	183,051	211,261	190,489	221,520	224,516
France.....	—	—	—	—	—	—	—	—	1
West Germany.....	77	—	—	—	—	—	—	—	—
Mexico.....	33,250	32,331	41,428	40,928	42,742	22,335	20,434	20,661	23,473
Northern Rhodesia.....	60,417	62,545	13,452	17,300	16,781	16,223	10	10	—
Peru.....	884	4,624	15,468	16,739	10,227	3,982	76,382	83,588	65,717
Republic of South Africa.....	6,089	2,218	6,063	6,744	13,665	—	—	14,402	18,409
Spain.....	—	—	—	—	—	—	—	—	—
Turkey.....	2,684	547	5,586	3,496	1,094	—	—	—	—
United Kingdom.....	—	542	—	—	—	—	—	—	—
Yugoslavia.....	—	—	—	—	—	—	—	—	—
Other.....	15	11	1,109	214	124	1,125	565	10	3
Total.....	262,279	261,591	283,396	307,332	273,360	277,997	303,422	340,705	332,321
Refined:									
Republic of the Congo.....	7,494	4,929	8,419	10,221	15,515	—	—	—	—
Belgium-Luxembourg.....	718	338	769	447	56	8,504	2,673	—	—
Canada.....	51,241	72,371	93,525	87,482	62,849	103,237	100,641	61,669	76,600
Chile.....	125,536	67,286	41,915	10,190	713	14,172	3,486	1,983	856
West Germany.....	4	3,577	2,738	2,545	4,158	24,305	8,727	14	—
Japan.....	—	27	799	(2)	—	—	—	—	—
Malta, Gozo, Cyprus.....	—	—	—	—	527	—	—	—	—
Mexico.....	6,278	7,919	4,033	2,924	4,235	6,675	2,038	34	8
Northern Rhodesia.....	1,232	10,656	13,866	28,055	18,052	16,396	5,785	—	18,997
Peru.....	13,003	17,771	16,001	14,224	11,349	17,205	8,234	54	—
Republic of South Africa.....	—	602	—	1,120	2,596	1,712	—	1,797	—
Sweden.....	—	1,024	224	2,688	1,063	3,428	2,789	—	—
United Kingdom.....	—	11,105	3,348	2,413	6,958	13,366	729	1,312	845
Yugoslavia.....	3,886	2,149	133	—	—	—	—	—	—
Other.....	5,696	2,558	5,970	—	393	5,158	7,607	2	1,514
Total.....	215,086	202,312	191,745	162,309	128,464	214,058	142,709	66,855	98,820
Scrap:									
Canada.....	1,919	6,971	1,196	3,202	4,089	2,370	1,717	2,165	3,924
Chile.....	—	—	108	—	—	—	—	1,476	—
Cuba.....	684	766	951	585	472	865	14	—	—
United Kingdom.....	25	3	8	2	—	70	52	4	—
Other.....	2,055	4,828	3,480	2,009	2,272	2,890	912	596	869
Total.....	4,683	12,568	5,743	5,798	7,060	6,195	2,695	4,231	4,793

¹ Data are general imports; that is, they include copper imported for immediate consumption plus material entering country under bond.² Less than 1 ton.

Source: U.S. Department of Commerce.

TABLE 47.—Copper (unmanufactured) imported into the United States, by countries in terms of copper content, short tons ¹

	1926	1927	1928	1929	1930	1931	1932
North America:							
Canada.....	53,329	54,499	76,425	102,750	108,835	80,439	59,034
Cuba.....	10,916	15,139	7,364	5,621	13,322	10,569	5,105
Mexico.....	52,628	58,123	66,184	85,285	72,662	55,118	37,715
Other.....	483	138	231	227	275	151	44
Total.....	117,356	127,909	150,204	193,883	195,094	146,277	101,898
South America:							
Bolivia.....	12	21	5	3	60	99	(¹)
Chile.....	116,354	102,810	107,067	169,494	94,318	85,315	54,730
Peru.....	47,719	52,019	58,286	62,465	56,076	44,876	23,218
Other.....	793	1,660	413	178	495	1,131	229
Total.....	164,878	156,510	165,771	232,130	150,949	131,221	78,177
Europe:							
Belgium-Luxembourg.....	847	(²)	31	547	1,658	45	2
France.....	1,179	168	279	2,487	1,673	157	96
West Germany.....	607	625	706	5,338	4,210	587	148
Malta, Gozo, and Cyprus.....		71					
Netherlands.....	25	5	25	61	30	16	
Norway.....	20		(³)	2,547		7	7
Sweden.....	37	96	535			28	
United Kingdom.....	15,704	10,403	2,627	7,738	1,901	929	105
Yugoslavia.....							
Other.....	19,972	4,600	4,919	9,169	7,316	124	47
Total.....	38,391	15,968	9,122	27,887	16,788	1,893	405
Asia:							
Japan.....		1		1,409	7,238		
Philippines.....	2			(⁴)	(⁵)		
Turkey.....							
Other.....			1			6	
Total.....	2	1	1	1,409	7,238	6	
Africa:							
Republic of the Congo.....		57,242	57,000	27,678	36,230		
Northern Rhodesia.....							
Republic of South Africa.....		1,349	1,838	105	118	699	4,174
Southern Rhodesia.....							
Other.....	68,649		9,307	3,931	62	10,409	10,127
Total.....	68,649	58,591	68,145	31,714	36,410	11,108	14,301
Oceania:							
Australia.....	194	154	185	93	2,057	2,424	1,195
Other.....	11	(⁶)					
Total.....	205	154	185	93	2,057	2,424	1,195
Grand total.....	389,481	359,133	393,428	487,116	408,536	292,929	195,976

See footnotes at end of table.

TABLE 47.—Copper (unmanufactured) imported into the United States, by countries in terms of copper content, short tons ¹—Continued

	1933	¹ 1934	¹ 1935	1936	1937	1938	1939
North America:							
Canada.....	16,935	22,119	44,443	14,674	28,538	50,451	57,500
Cuba.....	8,413	7,976	5,815	11,824	14,204	17,840	9,897
Mexico.....	43,203	53,410	47,012	34,982	33,827	47,142	52,539
Other.....				137	254	102	242
Total.....	68,551			61,617	106,823	115,535	120,178
South America:							
Bolivia.....	282			2,283	2,840	2,616	2,140
Chile.....	28,034	73,773	83,239	59,381	99,518	67,734	119,920
Peru.....	26,165	29,780	37,251	35,424	40,945	40,125	38,551
Other.....	84			713	520	352	419
Total.....	54,565			97,801	143,823	110,827	161,030
Europe:							
Belgium-Luxembourg.....	15			1,461	115	208	114
France.....	90	180	546	140	150	136	473
West Germany.....	80	268	233	(¹)	50		
Malta, Gozo, and Cyprus.....				1,298	4,361	1,429	1,625
Netherlands.....				60	17		35
Norway.....					8		
Sweden.....	632			161	223	266	557
United Kingdom.....	94	50	606	572	897	253	633
Yugoslavia.....	4,429	10,368	21,681	19,033	16,124	10,582	9,527
Other.....	5			2,174	19	205	206
Total.....	5,245			24,899	21,970	13,089	13,170
Asia:							
Japan.....							
Philippines.....				171	423	1,327	1,518
Turkey.....						2,544	5,356
Other.....					22		
Total.....				171	445	3,871	6,874
Africa:							
Republic of the Congo.....							
Northern Rhodesia.....							
Republic of South Africa.....	1,485	14	250	55	696	1,921	17,061
Southern Rhodesia.....							
Other.....	13,689			4,929	3,595	4,454	14,954
Total.....	15,174	14	250	4,984	4,290	6,375	32,015
Oceania:							
Australia.....	182	558	1,359	866	2,523	2,467	3,030
Other.....							
Total.....	182	558	1,359	866	2,523	2,467	3,030
Grand total.....	143,717	213,286	257,182	190,538	279,874	252,164	336,297

See footnotes at end of table.

TABLE 47.—Copper (unmanufactured) imported into the United States, by countries in terms of copper content, short tons ¹—Continued

	1940	1941	1942	1943	1944	1945	1946
North America:							
Canada.....	61,561	69,103	39,071	35,038	68,079	95,614	30,539
Cuba.....	11,560	8,067	9,094	7,885	7,123	9,422	12,378
Mexico.....	43,392	54,458	57,404	51,269	46,198	66,613	64,684
Other.....	325	349	234	450	36	36	306
Total.....	116,838	131,977	105,803	94,642	121,436	171,685	107,907
South America:							
Bolivia.....	4,139	6,456	5,379	6,300	3,798	4,929	4,573
Chile.....	205,333	460,370	500,058	499,856	549,002	452,073	207,525
Peru.....	42,087	36,184	30,609	33,242	34,517	31,375	30,374
Other.....	1,909	3,743	1,815	4,975	4,265	3,652	3,153
Total.....	253,418	506,753	537,861	534,373	591,582	492,029	245,625
Europe:							
Belgium-Luxembourg.....	6						1
France.....	169						
West Germany.....							
Malta, Gozo, and Cyprus.....	4,652			2,762	3,925		
Netherlands.....	3						
Norway.....	532						
Sweden.....			3,260				
United Kingdom.....	39	19					3,386
Yugoslavia.....							
Other.....		1					
Total.....	5,401	20	3,260	2,762	3,925		3,387
Asia:							
Japan.....	16						
Philippines.....	2,086	3,964	256				
Turkey.....	6,224		482	2,342	2,756		17,414
Other.....	2,307	1,830	1,616	10	10	10	2
Total.....	10,633	5,794	2,354	2,352	2,766	10	17,416
Africa:							
Republic of the Congo.....	60,815	81,994	89,050	76,977	63,404	80,624	4,469
Northern Rhodesia.....					157	89,962	11,942
Republic of South Africa.....	15,768	273	17,905	3,881	1,043	7,066	5,396
Southern Rhodesia.....			4,545	157			
Other.....	27,430	7,583		831		1,672	159
Total.....	104,013	89,850	111,500	81,846	64,604	188,324	21,966
Oceania:							
Australia.....	1,039	1,151	3,563	679	898	1,148	79
Other.....			22				
Total.....	1,039	1,151	3,615	679	898	1,148	79
Grand total.....	491,342	735,545	764,393	716,654	785,211	853,196	396,380

See footnotes at end of table.

TABLE 47.—Copper (unmanufactured) imported into the United States, by countries in terms of copper content, short tons ¹—Continued

	1947	1948	1949	1950	1951	1952	1953
North America:							
Canada.....	30,446	47,267	82,821	82,365	54,554	81,932	107,427
Cuba.....	14,953	16,270	15,840	22,891	22,302	19,934	18,206
Mexico.....	75,906	57,593	54,706	62,748	47,878	50,997	65,818
Other.....	264	624	553	624	744	408	629
Total.....	121,569	121,754	163,920	168,628	125,478	153,271	192,080
South America:							
Bolivia.....	6,752	6,729	4,671	5,220	4,449	3,097	3,972
Chile.....	223,124	320,703	285,396	292,215	268,359	362,303	281,074
Peru.....	32,597	19,318	22,316	28,502	10,054	11,317	26,523
Other.....	293	1,876	959	878	300	213	328
Total.....	262,766	348,626	313,332	326,815	283,162	376,930	311,897
Europe:							
Belgium-Luxembourg.....	27	59	273	474	-----	646	5,615
France.....	-----	103	158	3,801	1,587	1,806	2,180
West Germany.....	-----	-----	-----	44	-----	8,932	3,570
Malta, Gozo, and Cyprus.....	-----	2,689	6,888	6,630	5,556	5,441	3,680
Netherlands.....	-----	791	234	352	47	41	175
Norway.....	112	6	37	4,098	-----	1	4,427
Sweden.....	-----	-----	-----	57	-----	-----	2,217
United Kingdom.....	-----	995	1,925	940	6	37	2,194
Yugoslavia.....	10,317	2,288	14,727	10,998	6,223	14,838	7,775
Other.....	1,127	187	45	307	91	79	-----
Total.....	11,583	7,128	24,287	27,661	13,610	31,816	31,813
Asia:							
Japan.....	3,228	2	1,167	54,400	1,908	223	-----
Philippines.....	2,185	2,262	7,969	10,129	12,008	14,787	13,538
Turkey.....	1,953	-----	4,572	3,266	-----	3,779	11,894
Other.....	16	1,078	341	980	140	4	110
Total.....	7,390	3,332	14,049	68,775	14,656	18,793	25,642
Africa:							
Republic of the Congo.....	-----	-----	-----	103	-----	(¹)	5,799
Northern Rhodesia.....	101	* 19,061	* 27,244	84,291	43,717	28,225	88,042
Republic of South Africa.....	9,765	5,926	8,914	9,859	7,353	8,588	7,678
Southern Rhodesia.....	-----	-----	-----	* 3,009	98	167	212
Other.....	232	52	8	33	17	-----	-----
Total.....	10,098	25,039	36,166	97,295	51,185	36,980	101,731
Oceania:							
Australia.....	518	1,570	941	1,307	1,143	684	13,041
Other.....	-----	-----	-----	8	1	406	-----
Total.....	518	1,570	941	1,315	1,144	1,090	13,041
Grand total.....	413,894	507,449	522,704	690,389	489,135	618,880	676,104

See footnotes at end of table.

TABLE 47.—Copper (unmanufactured) imported into the United States, by countries in terms of copper content, short tons ¹—Continued

	1954	1955	1956	1957	1958	1959	1960	1961	1962
North America:									
Canada.....	89,911	107,034	120,489	120,224	74,813	112,318	117,641	78,354	98,753
Cuba.....	18,282	21,122	16,345	17,435	14,464	10,807	6,568	—	—
Mexico.....	51,229	49,642	52,835	47,746	50,023	29,493	22,656	20,963	23,779
Other.....	406	693	671	543	453	412	190	308	368
Total.....	159,828	178,491	190,340	185,948	139,753	153,030	147,055	99,625	122,900
South America:									
Bolivia.....	3,913	3,301	4,500	4,463	3,395	1,790	1,346	905	1,580
Chile.....	266,933	226,772	236,823	236,016	200,145	241,392	208,167	226,971	225,394
Peru.....	22,480	31,119	42,841	41,636	30,426	28,725	91,624	90,435	72,133
Other.....	7	20	772	986	963	464	11	(²)	28
Total.....	293,303	261,212	284,736	283,101	234,929	272,371	301,148	318,311	299,135
Europe:									
Belgium-Luxembourg.....	718	363	800	447	56	8,504	2,673	—	—
France.....	1,587	2,128	991	660	1,188	1,125	526	—	1
West Germany.....	81	3,562	2,744	2,552	4,173	24,342	8,739	14	—
Malta, Gozo, and Cyprus.....	—	4,368	6,945	8,937	6,911	3,524	—	—	—
Netherlands.....	—	2,291	11	22	392	727	506	—	23
Norway.....	5,664	149	5,969	—	20	50	248	—	—
Sweden.....	—	1,024	254	2,689	1,063	3,428	2,739	—	—
United Kingdom.....	25	11,650	3,356	2,415	7,186	13,436	781	1,316	846
Yugoslavia.....	3,886	2,149	138	—	—	—	—	—	—
Other.....	17	—	—	—	—	1	5,150	11	724
Total.....	11,978	27,744	21,208	17,722	20,988	55,137	21,412	1,341	1,594
Asia:									
Japan.....	1	94	799	1	26	—	—	—	—
Philippines.....	19,425	13,321	10,911	13,067	14,583	13,759	17,562	13,898	10,126
Turkey.....	2,664	547	5,586	3,496	1,094	1,094	547	—	—
Other.....	32	151	12	21	14	41	2	—	35
Total.....	22,122	14,113	17,308	16,585	15,717	14,894	18,111	13,898	10,161
Africa:									
Republic of the Congo.....	15,539	14,160	12,764	10,221	15,515	4,335	196	—	—
Northern Rhodesia.....	61,905	73,464	27,562	45,430	35,169	32,622	5,795	10	18,997
Republic of South Africa.....	13,482	13,089	21,291	19,945	29,169	30,981	28,228	23,474	24,460
Southern Rhodesia.....	—	—	1,085	—	—	49	625	21	784
Other.....	—	—	—	—	—	—	—	—	—
Total.....	90,926	100,713	62,702	75,596	79,853	67,987	34,844	23,505	44,241
Oceania:									
Australia.....	16,672	11,827	19,453	15,075	5,061	7,472	1,774	826	751
Other.....	—	—	—	5	—	—	—	163	69
Total.....	16,672	11,827	19,453	15,080	5,061	7,472	1,774	989	820
Grand total.....	594,829	594,100	595,747	594,032	496,301	570,891	524,344	457,669	478,851

¹ Data are general imports; that is, they include copper imported for immediate consumption plus material entering the country under bond.

² Data not available for all countries.

³ Less than 1 ton.

⁴ Refined copper credited to Portuguese Guiana and Angola by U.S. Department of Commerce has been added to Republic of the Congo.

⁵ Tonnages credited to Southern Rhodesia by U.S. Department of Commerce have been added to Northern Rhodesia.

⁶ Beginning July 1, 1954, classified as Federation of Rhodesia and Nyasaland.

⁷ Chiefly from Northern Rhodesia.

Source: U.S. Department of Commerce.

Production of copper in the British Empire had increased so rapidly in the 1930's that a surplus was available for export by 1939. When war was declared in Europe the United Kingdom situation changed quickly. In 1940 shipments to the United Kingdom tripled, and it was second only to Japan in receipts of copper from

the United States. Substantial quantities began going to the U.S.S.R. in 1939, and during the war years most of the refined copper exported from the United States (considerably below prewar levels) went to these two countries.

Exports of refined copper, which resumed its

TABLE 48.—*Brass and copper scrap imported into and exported from the United States, short tons*

	1926	1927	1928	1929	1930	1931	1932	1933	1934
Imports for consumption:									
Brass scrap, gross weight.....	4,311	3,993	6,077	7,031	3,573	2,212	1,259	40	243
Copper scrap, copper content.....	5,600	3,739	5,304	6,797	3,750	2,550	1,211	17	24
Exports:									
Brass scrap.....	25,132	45,997	42,413	26,867	22,613	11,592	15,073	15,348	30,196
Copper scrap.....	9,713	22,709	27,733	18,818	16,943	33,589	17,179	14,219	12,595

¹ Includes ingots.² Less than 1 ton.³ Beginning Jan. 1, 1952, classified as copper-base-alloy scrap (new and old).

Source: U.S. Department of Commerce.

prewar position as the most important export class in 1946, almost trebled in 1947. Copper was subject to export controls during most of the period. In September 1956 export restrictions on refined copper were removed, and shipments during 1957 rose 55 percent to 346,000 tons—the highest since 1940. In 1960, exports were the largest since 1929.

Tables 50 and 51 show exports of copper by classes and refined copper by country of destinations. Tables 52, 53, and 54 show exports of copper alloys and copper sulfate.

Foreign Countries

The principal copper-exporting countries are Canada, Chile, Republic of the Congo, and Northern Rhodesia. Exports and reexports for the United Kingdom averaged nearly 46,000 tons a year from 1951-62, but the United

Kingdom regularly requires large quantities of copper to meet its needs, and imports are shown in table 55.

Canada.—Most of the copper output is exported. The United States and the United Kingdom are the leading destinations of the refined copper shipped with important quantities going to France and West Germany in recent years. Exports by country of destination are shown in table 56.

Chile.—Chile ranked first as an exporter of copper in 4 of the 10 years under review. Although the United States has been the chief destination for Chilean copper, its share of the total dropped from 94 percent in 1938 to 38 percent in 1960. Substantial quantities have been shipped to the United Kingdom, West Germany, Netherlands, and Italy. Table 57 shows exports by country of destination.

TABLE 49.—Exports of insulated wire and cable by countries, short ton

Country	1939	1940	1941	1942	1943
Argentina.....	118	939	1,559	396	108
Australia.....	54	970	806	1,267	2,475
Canada.....	276	655	1,268	991	1,440
China.....	166	747	374	117	362
Colombia.....	770	669	710	145	698
Cuba.....	901	727	995	335	961
Egypt.....	(1)	3	3,363	8,788	4,455
France.....	8	5,757			
India.....	80	344	368	5,278	5,949
Mexico.....	395	557	824	1,157	943
Philippines.....	1,442	1,171	1,308		
U.S.S.R.....	1	11	2,773	31,940	50,135
United Kingdom.....	58	4,827	1,786	2,140	11,456
Other.....	3,156	9,598	11,442	7,881	13,777
Total.....	7,425	26,975	27,576	60,435	92,759
	1944	1945	1946	1947	1948
Argentina.....	195	169	424	1,970	1,546
Australia.....	1,444	156	125	81	118
Canada.....	1,913	1,025	1,243	2,956	3,658
China.....	61	240	570	1,290	5,880
Colombia.....	492	1,587	969	1,150	1,833
Cuba.....	410	1,710	1,122	1,890	2,248
Egypt.....	624	91			
France.....	554	823	688	765	1,514
India.....	5,433	2,745	223	84	857
Mexico.....	1,022	1,400	1,186	1,498	1,705
Philippines.....		202	1,106	1,967	1,571
U.S.S.R.....	91,685	36,707	13,351	678	12
United Kingdom.....	23,653	2,702	44	24	235
Other.....	16,948	9,835	9,317	10,941	14,087
Total.....	144,434	59,392	30,368	25,294	35,264

(1) Less than 1 ton. Source: U.S. Department of Commerce.

TABLE 50.—Copper exported from the United States, short tons

	1926	1927	1928	1929	1930	1931	1932	1933	1934	
Ore, concentrate, matte, copper content.....	2,733	3,618	1,916	2,790	90	150	18,433	22,714	16,393	
Refined.....	428,062	461,233	474,737	411,227	297,057	202,698	110,977	124,582	262,366	
Rods ¹	22,395	29,309	36,663	40,544	37,589	29,415	14,052	7,790	9,772	
Scrap.....	9,713	22,709	27,733	18,818	16,943	33,589	17,179	14,219	12,595	
Pipes and tubes.....	1,627	1,569	1,777	1,723	1,349	1,035	598	401	734	
Plates and sheets.....	2,516	3,537	3,020	3,161	5,492	2,269	836	567	4,761	
Wire and cable, bare ²	6,521	5,144	7,838	8,434	7,875	3,134	944	1,285	2,108	
Wire and cable, insulated.....	9,276	11,245	9,826	12,540	10,274	6,847	3,091	3,070	4,024	
Other copper manufactures.....	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	
	1935	1936	1937	1938	1939	1940	1941	1942	1943	
Ore, concentrate, matte, copper content.....	7,675	3,385	4,088	1,002	62	294	12	3,424	1,240	
Refined.....	260,735	220,390	295,064	370,545	372,777	356,481	103,602	131,406	175,859	
Rods ¹	14,271	15,701	15,332	14,678	23,629	20,677	11,151	326	1,482	
Scrap.....	9,542	13,224	20,914	21,811	17,643	7,149	3,259	1,215	(⁴)	
Pipes and tubes.....	608	948	1,091	822	1,570	3,836	2,132	4,778	9,994	
Plates and sheets.....	3,588	1,110	1,385	550	843	3,727	3,782	1,910	7,291	
Wire and cable, bare ²	1,577	2,146	4,695	5,362	3,630	8,856	7,392	10,490	7,134	
Wire and cable, insulated.....	4,877	5,613	7,748	7,243	7,425	26,975	27,576	60,435	92,759	
Other copper manufactures.....	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	
	1944	1945	1946	1947	1948	1949	1950	1951	1952	
Ore, concentrate, matte, copper content.....	(⁴)	34	23	115	2,473	200	616	234	648	
Refined.....	68,373	48,568	52,629	147,642	142,698	137,827	144,561	133,305	174,135	
Rods ¹	629	5,009	2,452	2,416	8,101	12,678	10,073	521	1,937	
Scrap.....	99	133	909	969	2,266	8,294	9,445	7,701	8,941	
Pipes and tubes.....	7,450	4,197	2,931	5,107	5,246	3,344	1,988	2,160	2,591	
Plates and sheets.....	6,625	3,797	3,687	4,374	2,853	1,088	581	572	553	
Wire and cable, bare ²	9,904	11,464	4,499	11,197	10,694	7,881	7,009	7,983	7,163	
Wire and cable, insulated.....	144,434	59,362	30,368	25,294	36,264	24,888	18,682	14,032	17,070	
Other copper manufactures.....	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	
	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Ore, concentrate, matte, copper content.....	495	2,369	12,897	13,717	15,656	11,475	2,982	11,111	4,478	1,916
Refined.....	109,580	215,951	199,819	223,103	346,025	384,868	158,938	433,762	428,718	336,525
Rods ¹	321	344	202	366	1,669	(¹)	(¹)	(¹)	(¹)	(¹)
Scrap.....	34,568	75,749	31,137	25,681	48,989	21,861	10,721	58,860	35,257	12,608
Pipes and tubes.....	1,622	1,199	1,292	1,550	1,354	1,606	799	726	949	864
Plates and sheets.....	367	300	542	337	265	165	313	500	355	349
Wire and cable, bare ²	9,313	4,548	6,976	11,104	11,119	5,030	3,378	3,278	1,995	2,875
Wire and cable, insulated.....	15,622	14,342	19,974	18,434	21,035	14,482	21,863	13,368	15,550	13,364
Other copper manufactures.....	294	250	234	185	238	2,302	4,352	5,181	7,362	6,768

¹ Beginning Jan. 1, 1958, not separately classified; included in "Other copper manufactures."

² Owing to changes in classifications, 1952-62 data not strictly comparable with earlier years.

³ Weight not recorded.

⁴ Less than 1 ton.

Source: U.S. Department of Commerce.

TABLE 51.—*Refined copper exported from the United States, by countries, short tons*

	1926	1927	1928	1929	1930	1931	1932
North America:							
Canada.....	7,649	7,725	10,687	19,352	7,117	3,579	93
Mexico.....	709	758	116	745	384	439	368
Other.....	121	57	19	2,058	648	43	42
Total.....	8,479	8,540	10,722	22,155	8,149	4,061	503
South America:							
Argentina.....	169	678	354	355	995	441	1,162
Brazil.....	86	165	477	1,122	642	73	64
Other.....	406	437	54	83	28	14	8
Total.....	661	1,280	885	1,560	1,665	528	1,234
Europe:							
Austria.....	28	123	56	67	56	12,195	6,244
Belgium-Luxembourg.....	41,029	44,749	38,716	22,875	13,182	(1)	950
Czechoslovakia.....	74	17	(1)	700	163	1,131	31,184
Denmark.....	434	500	999	888	1,050	54,740	15,224
France.....	87,575	55,979	85,720	87,632	70,619	29,142	11,672
West Germany.....	76,680	110,921	103,275	89,440	46,930	21,451	4,410
Hungary.....						8,923	233
Italy.....	41,479	43,135	58,274	42,246	39,354	298	67
Netherlands.....	32,143	52,306	32,263	16,267	13,573	14,430	7,795
Norway.....	476	718	1,203	683	865	56	
Poland and Danzig.....	84	431	968	235	112		
Spain.....	4,828	1,885	1,661	1,126	129		
Sweden.....	12,356	10,938	14,332	16,243	15,337		
Switzerland.....		140	353	168	(1)		
U.S.S.R.....	4,902	18,937	9,614	8,120	6,348	8,872	29,975
United Kingdom.....	90,160	91,283	92,908	87,725	71,395	47,125	285
Other.....	502	383	1,278	3,249	1,061	390	
Total.....	392,750	432,439	441,640	377,669	280,174	193,956	107,929
Asia:							
Burma.....							
China.....	4,084	2,820	2,946	2,802	2,813	2,362	370
French Indochina.....							
Hong Kong.....	363	353	243	270	707	778	421
India.....	2,208	2,997	1,225	2,022	1,340	837	188
Japan.....	18,672	12,238	16,198	3,977	1,594	94	224
Kwantung.....	121	190	165	1			28
Pakistan.....							
Taiwan.....							
Other.....	303	249	196	577	389	82	90
Total.....	25,751	18,847	20,973	9,649	6,843	4,153	1,311
Africa:							
Algeria.....							
Other.....	370	2	482	19	1		
Total.....	370	2	482	19	1		
Oceania:							
Australia.....	1	3	6	7	1	(1)	
Other.....	50	122	29	168	224		
Total.....	51	125	35	175	225	(1)	
Grand total¹.....	428,062	461,233	474,737	411,227	297,057	202,698	110,977

See footnotes at end of table.

TABLE 51.—*Refined copper exported from the United States, by countries, short tons—Continued*

	1933	1934	1935	1936	1937	1938	1939
North America:							
Canada.....	46	81	104	190	2,464	782	98
Mexico.....	1,728	1,359	886	1,905	1,117	1,019	1,329
Other.....	12	17	52	202	66	47	120
Total.....	1,786	1,457	1,042	2,297	3,647	1,848	1,547
South America:							
Argentina.....	2,387	1,589	919	1,019	2,583	2,514	1,596
Brazil.....	30	225	872	477	352	1,739	3,769
Other.....	14	30	35	83	104	189	129
Total.....	2,431	1,844	1,826	1,579	3,039	4,442	5,494
Europe:							
Austria.....		1	(1)		163	499	
Belgium-Luxembourg.....	7,241	9,261	12,870	14,707	14,639	9,175	5,804
Czechoslovakia.....	(1)	20	84	59	5,672	33,414	1,048
Denmark.....	1,134	1,366	2,231	1,856	3,550	1,295	1,735
France.....	36,428	58,159	32,173	40,872	39,197	32,111	76,024
West Germany.....	17,381	36,381	24,916	32,639	37,535	74,333	21,284
Hungary.....				56	56	1,539	3,679
Italy.....	15,019	21,521	45,247	23,559	20,812	21,874	28,014
Netherlands.....	4,570	10,891	8,358	3,256	7,484	6,890	5,422
Norway.....	501	949	983	1,537	636	691	1,091
Poland and Danzig.....	1,214	2,828	5,361	6,985	3,687	12,456	12,760
Spain.....		11	11				24
Sweden.....	6,098	14,193	12,574	15,506	17,360	18,625	24,984
Switzerland.....						648	3,253
U.S.S.R.....			168	5	2,197	55	22,748
United Kingdom.....	13,298	41,208	54,522	30,548	52,791	30,615	22,228
Other.....	236	622	608	378	586	1,512	182
Total.....	103,120	197,411	200,106	172,254	206,365	245,732	230,880
Asia:							
Burma.....							
China.....	2,035	1,878	1,743	2,548	4,469	476	1,040
French Indochina.....							5,264
Hong Kong.....	703	516	882	302	2,290	2,859	45
India.....	176	508	1,235	235	890	653	1,590
Japan.....	14,079	56,885	53,133	39,926	72,844	108,940	124,638
Kwantung.....	84	168	112	3	486	2,773	1,678
Pakistan.....							
Taiwan.....							
Other.....	109	1,386	493	625	773	781	286
Total.....	17,186	61,341	57,598	43,639	81,752	116,482	134,541
Africa:							
Algeria.....							
Other.....	59	313	161	620	261	2,040	315
Total.....	59	313	161	620	261	2,040	315
Oceania:							
Australia.....			2	1	(1)	1	(1)
Other.....							
Total.....			2	1	(1)	1	(1)
Grand total.....	124,582	262,366	260,735	220,390	295,064	370,545	372,777

See footnotes at end of table.

TABLE 51.—*Refined copper exported from the United States, by countries, short tons—Continued*

	1940	1941	1942	1943	1944	1945	1946
North America:							
Canada.....	327	285	208	162	134	60	67
Mexico.....	2,788	3,043	3,376	6,404	4,475	5,690	833
Other.....	342	118	88	9	1	45	51
Total.....	3,457	3,446	3,622	6,575	4,610	5,795	951
South America:							
Argentina.....	4,211	892	(1)	5		(1)	1,427
Brazil.....	5,217	6,718	1,130	726	34	5,674	4,453
Other.....	91	136	100	191	29	451	259
Total.....	9,519	7,746	1,230	922	63	6,125	6,139
Europe:							
Austria.....							
Belgium-Luxembourg.....	1,187					1,580	728
Czechoslovakia.....							563
Denmark.....	560						872
France.....	30,404					3,646	10,457
West Germany.....							
Hungary.....	4,441						
Italy.....	33,837					4,408	392
Netherlands.....	3,198						1,289
Norway.....	65						416
Poland and Danzig.....							
Spain.....	38					551	
Sweden.....	6,035				1,105	1,432	8,674
Switzerland.....	6,827			110		4,068	6,180
U.S.S.R.....	54,478	5,768	15,238	1,403	20,971	221	43
United Kingdom.....	70,508	53,734	107,949	166,750	41,507	19,281	6,553
Other.....	4,109	1	1	5		9	1,068
Total.....	215,687	59,503	123,188	168,258	63,583	35,316	37,053
Asia:							
Burma.....							
China.....	4,820	8,461	3,002	13		542	2,010
French Indochina.....	255						3
Hong Kong.....	204	14					
India.....	1,182	2,437	251	3	7	1	5,651
Japan.....	116,973	16,934					
Kwantung.....	2,223	251					
Pakistan.....							
Taiwan.....							
Other.....	1,804	1,172	88	2	12	2	84
Total.....	127,461	29,269	3,341	18	19	545	7,748
Africa:							
Algeria.....				58	51	595	565
Other.....	265	271	24	15	40	18	116
Total.....	265	271	24	73	91	613	681
Oceania:							
Australia.....	42	3,364		1		169	56
Other.....		3	1	2	7		1
Total.....	42	3,367	1	3	7	169	57
Grand total.....	356,431	103,602	131,406	175,859	68,373	48,563	52,629

See footnotes at end of table.

TABLE 51.—*Refined copper exported from the United States, by countries, short tons—Continued*

	1947	1948	1949	1950	1951	1952	1953
North America:							
Canada.....	84	47	50	94	37	12,884	833
Mexico.....	59	558	6	2	28	51	35
Other.....	43	47	12	5	32	17	8
Total.....	186	652	68	101	97	12,952	876
South America:							
Argentina.....	5,043	4,327	1,871	110	1,276	—	4,353
Brazil.....	601	1,595	3,198	1,356	3,621	5,496	9,635
Other.....	245	183	74	128	81	104	214
Total.....	5,889	6,105	5,143	1,694	4,978	5,600	14,202
Europe:							
Austria.....	—	811	2,481	192	655	1,356	286
Belgium-Luxembourg.....	3,919	2,576	1,404	578	562	—	560
Czechoslovakia.....	2,902	3,261	—	—	—	—	—
Denmark.....	635	1,593	831	1,982	1,372	1,447	917
France.....	6,746	10,222	23,948	18,401	18,626	35,573	17,834
West Germany.....	3,984	8,685	10,600	3,417	10,273	20,447	12,035
Hungary.....	446	—	—	—	—	—	—
Italy.....	7,646	4,463	19,914	16,640	7,948	17,040	10,971
Netherlands.....	10,283	8,776	11,611	6,148	8,190	5,994	11,362
Norway.....	700	896	495	3,217	1,911	1,674	3,266
Poland and Danzig.....	2,475	1,676	—	—	—	—	—
Spain.....	—	—	107	—	—	2,352	—
Sweden.....	9,073	(1)	2,240	2,015	593	2,242	—
Switzerland.....	8,329	11,817	9,374	5,152	5,415	9,562	6,365
U.S.S.R.....	—	—	—	—	—	—	—
United Kingdom.....	70,855	62,776	26,236	74,245	70,161	48,116	22,367
Other.....	504	514	241	563	861	921	644
Total.....	128,377	117,566	109,482	132,550	126,567	146,724	86,607
Asia:							
Burma.....	—	—	14	—	—	—	—
China.....	647	326	—	—	—	—	—
French Indochina.....	—	—	6	—	—	—	—
Hong Kong.....	65	46	—	—	—	—	—
India.....	11,063	15,097	20,514	8,989	217	6,243	1,830
Japan.....	—	—	—	—	—	365	2,350
Kwantung.....	—	—	—	—	—	—	—
Pakistan.....	—	56	749	112	—	959	1,430
Taiwan.....	—	—	—	—	—	—	2,176
Other.....	14	16	95	35	154	221	1
Total.....	11,809	15,541	21,378	9,136	371	7,788	7,787
Africa:							
Algeria.....	168	2,733	1,727	1,174	76	446	—
Other.....	259	1	3	—	560	454	8
Total.....	427	2,734	1,730	1,174	636	900	8
Oceania:							
Australia.....	954	—	—	—	650	166	100
Other.....	(1)	—	26	6	6	5	—
Total.....	954	—	26	6	656	171	100
Grand total ²	147,642	142,596	137,827	144,561	133,305	174,135	109,580

See footnotes at end of table.

TABLE 51.—*Refined copper exported from the United States, by countries, short tons—Continued*

	1954	1955	1956	1957	1958	1959	1960	1961	1962
North America:									
Canada.....	824	1,164	2,875	3,546	2,650	3,313	1,333	2,441	1,013
Mexico.....	70	292	104	158	707	27	106	154	107
Other.....	7	28	6	20	812	9	8	24	10
Total.....	901	1,484	2,985	3,724	4,169	3,349	1,447	2,619	1,130
South America:									
Argentina.....	4,736	2,975	—	11,162	13,007	4,268	12,469	12,885	8,931
Brazil.....	28,613	8,906	8,743	8,776	8,874	4,972	14,892	20,288	4,785
Other.....	113	29	96	495	342	87	137	289	123
Total.....	33,462	11,910	8,839	20,423	22,223	9,327	27,498	33,462	13,819
Europe:									
Austria.....	1,501	1,261	295	224	201	—	—	38	—
Belgium-Luxembourg.....	742	1,155	55	1,127	2,156	270	3,318	2,164	1,574
Czechoslovakia.....	—	—	—	—	—	—	—	1,572	—
Denmark.....	464	270	457	800	806	—	—	—	1,848
France.....	39,239	65,062	59,969	54,687	91,155	42,567	56,866	60,306	39,044
West Germany.....	30,236	35,251	32,900	50,773	65,831	38,624	105,998	77,352	67,353
Hungary.....	—	—	—	—	—	—	—	—	—
Italy.....	18,081	9,659	26,159	33,535	30,547	15,234	61,459	63,047	54,314
Netherlands.....	24,343	16,224	8,367	7,845	14,250	7,131	13,558	9,102	6,467
Norway.....	3,628	2,575	2,472	3,212	4,174	1,820	3,490	2,938	2,658
Poland and Danzig.....	—	—	—	—	—	—	—	—	—
Spain.....	—	—	—	2,192	66	—	28	—	418
Sweden.....	5,941	6,447	1,824	2,519	7,163	1,320	5,314	4,486	3,861
Switzerland.....	10,587	8,686	15,093	14,620	11,395	1,870	6,945	6,568	4,126
U.S.S.R.....	—	—	—	—	—	—	—	—	—
United Kingdom.....	25,347	28,092	15,569	89,649	115,462	26,300	90,664	78,371	52,186
Other.....	228	—	493	4,603	3,753	3,791	10,726	10,548	7,529
Total.....	160,337	174,681	163,653	265,787	346,959	138,827	358,436	314,492	241,378
Asia:									
Burma.....	—	—	—	—	—	—	—	—	—
China.....	—	—	—	—	—	—	—	—	—
French Indochina.....	—	—	—	—	—	—	—	—	—
Hong Kong.....	—	—	—	—	—	—	—	—	—
India.....	6,237	4,830	15,835	7,617	957	922	5,258	15,557	65,124
Japan.....	6,841	184	29,606	46,850	8,750	5,333	35,569	60,839	13,134
Kwantung.....	—	—	—	—	—	—	—	—	—
Pakistan.....	—	—	—	—	34	—	—	96	3
Taiwan.....	7	187	969	129	563	—	1,611	631	540
Other.....	105	7	24	219	541	69	163	5	252
Total.....	13,190	5,208	46,434	54,815	10,845	6,324	42,601	77,128	79,053
Africa:									
Algeria.....	174	—	—	—	—	—	—	—	10
Other.....	167	273	632	716	—	—	6	1,511	382
Total.....	341	273	632	716	—	—	6	1,511	392
Oceania:									
Australia.....	7,720	6,263	560	560	672	1,111	3,774	3,041	753
Other.....	—	—	—	—	—	—	—	—	—
Total.....	7,720	6,263	560	560	672	1,111	3,774	3,041	753
Grand total ¹	215,951	199,819	223,103	346,025	384,868	158,938	433,762	432,253	336,525

¹ Less than 1 ton.² Includes countries not shown in stub.

Source: U.S. Department of Commerce.

TABLE 52.—Copper-base alloys, including brass and bronze, exported from the United States,¹ by classes

	1926		1927		1928		1929	
	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands
Bars, rods, and shapes.....	1,645	\$553	1,309	\$410	997	\$394	1,787	\$756
Castings and forgings.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Hardware.....	(2)	815	(2)	921	(2)	828	(2)	1,145
Ingot.....	25,132	4,944	46,997	8,824	42,413	7,947	879	268
Pipe fittings and valves.....	1,718	1,828	1,639	1,807	2,021	2,076	2,296	2,466
Pipes and tubes.....	1,779	922	1,717	788	2,130	1,075	2,647	1,416
Plates, sheets, and strips.....	732	332	447	239	1,205	511	1,148	574
Plumbers brass goods.....	220	232	357	394	484	541	539	636
Powder.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Scrap and other forms.....	(2)	(2)	(2)	(2)	(2)	(2)	26,867	5,899
Semifabricated forms, n.e.c.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Welding rods and wire.....	633	407	598	380	678	435	779	544
Other copper-base-alloy manufactures.....	(2)	3,641	(2)	3,753	(2)	3,811	(2)	3,799
Total.....	(2)	13,674	(2)	17,516	(2)	17,618	(2)	17,503
	1930		1931		1932		1933	
	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands
Bars, rods, and shapes.....	1,576	\$621	1,040	\$287	628	\$155	385	\$114
Castings and forgings.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Hardware.....	(2)	807	(2)	440	(2)	218	(2)	188
Ingot.....	1,004	266	685	106	78	11	66	11
Pipe fittings and valves.....	1,800	1,850	929	1,014	414	486	422	470
Pipes and tubes.....	2,317	1,059	1,595	557	773	228	428	152
Plates, sheets, and strips.....	708	344	323	183	216	76	131	54
Plumbers brass goods.....	492	575	353	376	175	183	216	214
Powder.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Scrap and other forms.....	22,613	4,157	11,592	1,519	15,073	1,256	15,348	1,368
Semifabricated forms, n.e.c.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Welding rods and wire.....	671	427	618	315	116	51	120	50
Other copper-base-alloy manufactures.....	(2)	2,890	(2)	1,546	(2)	902	(2)	743
Total.....	(2)	12,996	(2)	6,293	(2)	3,565	(2)	3,373
	1934		1935		1936		1937	
	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands
Bars, rods, and shapes.....	625	\$209	791	\$251	907	\$312	8,012	\$2,268
Castings and forgings.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Hardware.....	(2)	282	(2)	324	(2)	375	(2)	491
Ingot.....	39	9	101	18	175	33	239	71
Pipe fittings and valves.....	642	720	718	818	952	1,062	1,349	1,707
Pipes and tubes.....	354	143	498	188	695	300	1,361	706
Plates, sheets, and strips.....	264	110	272	114	274	117	436	224
Plumbers brass goods.....	300	306	376	385	466	480	637	679
Powder.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Scrap and other forms.....	30,196	3,286	29,792	3,290	12,340	1,564	18,551	3,198
Semifabricated forms, n.e.c.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Welding rods and wire.....	208	99	188	97	283	141	328	186
Other copper-base-alloy manufactures.....	(2)	1,058	(2)	1,144	(2)	1,283	(2)	1,927
Total.....	(2)	6,222	(2)	6,638	(2)	5,067	(2)	11,467
	1938		1939		1940		1941	
	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands
Bars, rods, and shapes.....	1,156	\$411	4,546	\$1,183	31,590	\$8,895	18,603	\$3,139
Castings and forgings.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Hardware.....	(2)	331	(2)	395	(2)	543	(2)	833
Ingot.....	118	24	813	230	674	188	124	42
Pipe fittings and valves.....	986	1,257	1,270	1,572	1,472	1,787	1,527	2,101
Pipes and tubes.....	693	311	1,119	501	2,134	1,149	1,540	952
Plates, sheets, and strips.....	549	242	1,117	534	58,644	21,719	30,770	11,378
Plumbers brass goods.....	499	576	722	802	712	796	655	793
Powder.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Scrap and other forms.....	15,988	2,295	5,338	743	5,887	1,087	722	116
Semifabricated forms, n.e.c.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Welding rods and wire.....	184	104	678	336	4,656	2,686	3,769	1,897
Other copper-base-alloy manufactures.....	(2)	2,394	(2)	2,622	(2)	6,409	(2)	5,304
Total.....	(2)	7,945	(2)	8,918	(2)	45,229	(2)	26,555

See footnotes at end of table.

TABLE 52.—Copper-base alloys, including brass and bronze, exported from the United States,¹ by classes—Continued

	1942		1943		1944		1945	
	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands
Bars, rods, and shapes.....	10,893	\$3,835	22,579	\$8,828	23,095	\$7,831	8,601	\$3,266
Castings and forgings.....	184	182	137	186	147	171	359	290
Hardware.....	(²)	463	(²)	309	(²)	251	(²)	449
Ingots.....	268	85	227	64	329	111	5,985	1,517
Pipe fittings and valves ¹	1,694	1,862	1,153	1,635	1,007	1,864	285	470
Pipes and tubes.....	2,752	1,784	5,952	3,576	5,791	3,544	1,759	1,063
Plates, sheets, and strips.....	63,172	24,056	75,640	29,160	110,045	40,443	25,181	9,288
Plumbers brass goods.....	230	361	160	308	103	208	372	559
Powder.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Scrap and other forms.....	168	28	6	1	38	6	421	83
Semifabricated forms, n.e.c.....	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)
Welding rods and wire.....	3,517	1,497	4,490	2,327	3,882	2,107	1,548	1,080
Other copper-base-alloy manufactures.....	(²)	6,101	(²)	4,599	(²)	4,937	(²)	2,949
Total.....	(²)	40,254	(²)	51,593	(²)	61,473	(²)	21,043
	1946		1947		1948		1949	
	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands
Bars, rods, and shapes.....	4,348	\$1,855	5,400	\$2,955	2,075	\$1,387	1,563	\$1,045
Castings and forgings.....	333	288	400	392	345	379	304	273
Hardware.....	(²)	801	(²)	1,814	(²)	1,146	(²)	981
Ingots.....	1,708	485	1,287	521	424	191	794	248
Pipe fittings and valves ¹	360	549	467	778	595	1,032	696	1,053
Pipes and tubes.....	1,712	1,080	2,895	2,367	2,484	2,303	1,574	1,523
Plates, sheets, and strips.....	3,038	1,516	5,976	4,224	3,931	2,967	1,980	1,688
Plumbers brass goods.....	913	1,724	1,885	4,085	1,594	3,384	1,571	3,188
Powder.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Scrap and other forms.....	1,184	301	3,157	1,062	6,584	2,247	13,963	4,674
Semifabricated forms, n.e.c.....	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)
Welding rods and wire.....	2,338	1,769	3,201	3,257	2,455	2,639	1,447	1,596
Other copper-base-alloy manufactures.....	(²)	4,729	(²)	6,428	(²)	4,787	(²)	4,145
Total.....	(²)	15,197	(²)	27,883	(²)	22,442	(²)	30,564
	1950		1951		1952		1953	
	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands
Bars, rods, and shapes.....	866	\$653	914	\$866	2,212	\$2,371	1,259	\$1,232
Castings and forgings.....	264	309	496	633	739	965	607	912
Hardware.....	(²)	781	(²)	924	(²)	1,597	(²)	2,661
Ingots.....	531	203	2,077	1,269	2,377	1,945	2,553	1,503
Pipe fittings and valves ¹	814	1,339	707	1,571	726	1,665	727	1,720
Pipes and tubes.....	1,029	1,040	1,485	1,679	1,400	1,817	2,838	2,707
Plates, sheets, and strips.....	937	839	829	787	925	1,109	641	834
Plumbers brass goods.....	1,922	4,010	2,242	5,771	(⁴)	5,248	2,657	6,454
Powder.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	62	74	80
Scrap and other forms.....	9,054	2,654	4,857	2,091	6,261	2,360	33,680	13,066
Semifabricated forms, n.e.c.....	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	70	17	31
Welding rods and wire.....	1,153	1,294	1,446	1,960	1,532	2,337	634	1,334
Other copper-base-alloy manufactures.....	(²)	4,085	(²)	5,160	(²)	569	(²)	421
Total.....	(²)	17,207	(²)	22,741	(²)	22,127	(²)	32,064
	1954		1955		1956		1957	
	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands
Bars, rods, and shapes.....	455	\$519	648	\$821	734	\$1,039	585	\$864
Castings and forgings.....	435	709	468	777	405	773	435	690
Hardware.....	(²)	2,496	(²)	3,399	(²)	3,784	(²)	3,864
Ingots.....	2,601	1,762	810	1,186	662	1,243	373	656
Pipe fittings and valves ¹	983	2,222	1,302	3,047	1,197	3,263	1,301	3,262
Pipes and tubes.....	865	1,215	1,157	1,715	1,420	2,293	1,461	2,367
Plates, sheets, and strips.....	436	643	717	1,193	857	1,562	789	1,424
Plumbers brass goods.....	2,920	6,960	3,081	7,839	2,887	8,193	2,801	7,681
Powder.....	68	71	196	237	181	239	200	222
Scrap and other forms.....	93,972	38,469	45,260	24,597	50,485	29,815	69,996	32,968
Semifabricated forms, n.e.c.....	16	43	22	57	34	63	27	63
Welding rods and wire.....	760	1,444	823	1,642	890	2,192	777	1,680
Other copper-base-alloy manufactures.....	(²)	823	(²)	556	(²)	380	(²)	489
Total.....	(²)	57,086	(²)	46,976	(²)	54,847	(²)	56,319

See footnotes at end of table.

TABLE 52.—Copper-base alloys, including brass and bronze, exported from the United States,¹ by classes—Continued

	1958		1959		1960		1961		1962	
	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands	Short tons	Value, thousands
Bars, rods, and shapes.....	565	\$772	515	\$904	571	\$927	658	\$1,132	910	\$1,463
Castings and forgings.....	245	443	136	260	276	688	502	1,014	933	2,354
Hardware.....	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Ingots.....	276	505	383	898	699	1,646	469	906	343	466
Pipe fittings and valves ²	1,528	3,454	1,691	3,851	1,400	3,391	1,368	3,416	1,376	3,384
Pipes and tubes.....	1,198	1,595	1,273	1,849	1,035	1,488	1,343	1,744	1,763	2,486
Plates, sheets, and strips.....	555	951	573	1,172	650	1,663	578	1,622	1,138	2,299
Plumbers brass goods.....	2,670	6,998	2,453	6,694	2,202	5,872	2,151	5,889	2,008	5,489
Powder.....	283	273	391	402	325	385	483	518	519	576
Scrap and other forms.....	28,502	10,457	29,406	12,497	122,957	52,220	116,654	52,226	36,209	15,325
Semifabricated forms, n.e.c.....	34	76	62	161	13	40	13	36	46	127
Welding rods and wire.....	709	1,382	724	1,414	794	1,588	689	1,738	785	1,845
Other copper-base-alloy manufactures.....	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Total.....	36,565	25,906	37,607	30,002	130,922	69,906	124,938	70,240	46,030	36,024

¹ 1952-60 data known to be not comparable with earlier years.
² Beginning August 1941 castings and forgings separately classified; formerly included with "Other manufactures."
³ Weight not recorded.
⁴ Not separately classified prior to 1952; included with "Other manufactures."
⁵ Not separately classified prior to 1929; included with "Ingots."
⁶ Not recorded.

⁷ Beginning July 1941 shapes separately classified; formerly included with "Other manufactures."
⁸ Beginning January 1, 1945, valves not separately classified; included in "Industrial machinery."
⁹ Weight not recorded from January through June; July through December 1, 138 tons valued at \$2,841,000.
¹⁰ Beginning January 1, 1958, not separately classified.
Source: U.S. Department of Commerce.

TABLE 53.—Unfabricated copper-base alloy¹ ingots², bars, rods, shapes, plates, and sheets exported from the United States

Year	Short tons	Value, thousands
1926.....	2,377	\$885
1927.....	1,756	649
1928.....	2,202	905
1929.....	3,814	1,598
1930.....	3,288	1,231
1931.....	1,948	525
1932.....	922	242
1933.....	582	180
1934.....	928	328
1935.....	1,164	383
1936.....	1,356	463
1937.....	8,687	2,573
1938.....	1,823	678
1939.....	6,476	1,947
1940.....	90,908	30,802
1941.....	39,497	14,558
1942.....	74,333	27,977
1943.....	98,446	38,052
1944.....	133,470	48,385
1945.....	39,807	14,071
1946.....	9,094	3,956
1947.....	12,663	7,701
1948.....	6,430	4,545
1949.....	4,287	3,081
1950.....	2,334	1,694
1951.....	3,820	2,952
1952 ³	5,514	5,425
1953 ³	4,453	3,569
1954 ³	3,492	2,924
1955 ³	2,175	3,201
1956 ³	2,333	3,844
1957 ³	1,747	2,944
1958 ³	1,396	2,229
1959 ³	1,471	2,874
1960 ³	1,920	4,236
1961 ³	1,705	3,659
1962 ³	2,391	4,228

¹ Includes brass and bronze.
² Ingots not separately classified before 1929, included with scrap.
³ 1952-62 data known to be not strictly comparable with earlier years.
Source: U.S. Department of Commerce.

TABLE 54.—Copper sulfate (blue vitriol) exported from the United States

Year	Short tons	Value, thousands
1926.....	2,399	\$231
1927.....	3,103	321
1928.....	4,333	455
1929.....	3,210	368
1930.....	2,531	253
1931.....	3,595	277
1932.....	2,066	115
1933.....	1,375	93
1934.....	1,929	129
1935.....	2,254	142
1936.....	5,367	343
1937.....	11,764	1,212
1938.....	15,625	1,229
1939.....	14,620	1,157
1940.....	27,740	2,294
1941.....	34,511	2,951
1942.....	35,082	3,444
1943.....	30,367	3,075
1944.....	28,922	2,844
1945.....	34,967	3,419
1946.....	41,345	4,077
1947.....	34,021	4,100
1948.....	42,135	6,515
1949.....	31,717	4,321
1950.....	30,149	4,151
1951.....	43,129	8,754
1952.....	43,421	8,483
1953.....	32,659	6,250
1954.....	29,762	5,781
1955.....	37,382	8,382
1956.....	30,177	8,036
1957.....	33,644	6,534
1958.....	7,248	1,176
1959.....	2,672	675
1960.....	14,841	3,377
1961.....	7,575	1,542
1962.....	1,916	456

Source: U.S. Department of Commerce.

TABLE 55.—Imports of copper into the United Kingdom, by countries, short tons

Country	1951			1952		
	Blister	Electro-lytic	Fire-refined	Blister	Electro-lytic	Fire-refined
Belgium.....		15,735			31,061	
Canada.....		51,536			41,915	5
Chile.....	3,864		6,046	1,820		3,727
Republic of the Congo.....					66	
West Germany.....		18,472			17,922	
Northern Rhodesia.....	142,725	86,424		189,221	85,548	
Norway.....		1,428			1,483	
Peru.....						
Republic of South Africa.....					2	1,680
United States.....		71,852			49,974	
Other countries.....	54	19	150		4,153	
Total.....	146,643	245,466	6,196	191,041	232,124	5,412
Country	1953			1954		
	Blister	Electro-lytic	Fire-refined	Blister	Electro-lytic	Fire-refined
Belgium.....		17,339			16,046	
Canada.....		53,526			72,240	
Chile.....				7,103	21,492	12,116
Republic of the Congo.....		2,716			9,182	
West Germany.....		22,883			12,876	
Northern Rhodesia.....	121,037	125,663		139,626	125,694	
Norway.....		549			1,327	
Peru.....		11			3,044	
Republic of South Africa.....			5,694			2,134
United States.....		22,734	1,949		16,811	4,732
Other countries.....	635	1,831	13	1,829	1,500	693
Total.....	121,672	247,252	7,656	148,558	280,212	19,675
Country	1955			1956		
	Blister	Electro-lytic	Fire-refined	Blister	Electro-lytic	Fire-refined
Belgium.....		7,577			5,473	
Canada.....		71,432			65,706	
Chile.....	8,000	30,663	29,100		48,648	37,392
Republic of the Congo.....		5,684			8,624	
West Germany.....		8,679			1,887	
Northern Rhodesia.....	124,505	117,784		116,872	144,803	
Norway.....		3,147			548	
Peru.....		6,356			2,959	
Republic of South Africa.....			1,520		271	953
United States.....		28,170	3,839		10,599	
Other countries.....	3,994	6,890	349	2,453	1,075	266
Total.....	136,499	286,382	34,808	119,325	290,593	38,611

TABLE 55.—Imports of copper into the United Kingdom, by countries, short tons—Continued

Country	1957			1958		
	Blister	Electro-lytic	Fire-refined	Blister	Electro-lytic	Fire-refined
Belgium.....		675			1,337	
Canada.....		85,795			89,201	
Chile.....	3,298	45,210	40,634	16,072	24,212	49,840
Republic of the Congo.....		3,359			3,920	
West Germany.....		84				
Northern Rhodesia.....	124,624	118,094		90,583	120,400	
Norway.....		1,226			1,858	
Peru.....		2,671			2,873	
Republic of South Africa.....		226	533			840
United States.....		82,629	10,640		104,767	6,517
Other countries.....	1,633	561		729	141	336
Total.....	129,555	340,530	51,807	107,384	348,709	57,533
Country	1959			1960		
	Blister	Electro-lytic	Fire-refined	Blister	Electro-lytic	Fire-refined
Belgium.....		452			1,688	
Canada.....		81,576			115,246	
Chile.....	32,422	23,228	46,984	47,759	29,884	50,371
Republic of the Congo.....		4,541			3,134	
West Germany.....		6			2,658	
Northern Rhodesia.....	74,744	182,143		76,371	200,865	
Norway.....		3,455			2,464	
Peru.....		588		693	2,552	
Republic of South Africa.....		280	5,683			3,349
United States.....		31,057	1,959	1,120	66,009	6,213
Other countries.....	5	627		17	4,893	139
Total.....	107,171	327,953	54,626	125,960	429,393	60,072
Country	1961			1962		
	Blister	Electro-lytic	Fire-refined	Blister	Electro-lytic	Fire-refined
Belgium.....		815			772	
Canada.....		112,890			98,240	
Chile.....	50,402	21,506	33,861	50,250	36,541	29,215
Republic of the Congo.....		4,043			3,080	
West Germany.....	34	547			22,789	
Northern Rhodesia.....	80,560	202,470	829	43,194	213,078	1,540
Norway.....		1,463			342	
Peru.....	22,408			23,024	6,718	
Republic of South Africa.....		101	593			1,960
United States.....	1,025	49,276	4,481		53,275	1,063
Other countries.....	3	4,825	19		5,282	275
Total.....	154,432	397,936	39,783	116,468	440,117	34,053

TABLE 56.—Exports of refined copper from Canada, short tons

	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Australia.....		1,707		1,126	3,993		1,007	56	290	1,847	2,239	1,288
Belgium.....								1,008	3,738	4,481	5,745	4,951
Brazil.....	2,688	2,835	2,345	5,751	496	257	1,541	1,994	324	302	1,169	38
France.....	5,700	8,537	2,940	7,728	8,957	9,860	12,502	20,806	10,038	12,880	15,885	13,928
West Germany.....	1,258	480	84	404	937		1,315	14,051	9,510	12,940	13,355	11,907
India.....	3,649	2,582		2,211	1,724	3,072	3,988	11,652	7,619	10,908	3,673	3,440
Italy.....	2,451				112		1,092	6,137	1,400	2,516	3,497	2,160
Japan.....							2	276	110	4,961	11,207	2,937
Netherlands.....			22		196		341	9,089	2,939	5,318	8,992	4
Sweden.....	3,998	1,796		56	25		3,381	785	224	2,522	4,894	5,376
Switzerland.....	224		224	168	308		1,567	2,380		843	674	4
United Kingdom.....	51,918	41,643	51,394	77,967	69,198	63,990	84,672	90,927	63,487	110,540	115,859	93,693
United States.....	28,843	52,630	74,655	60,814	67,071	96,747	86,300	63,865	101,501	104,602	64,189	76,606
Other.....	1,103	1,475	340	5	182	18	1,106	1,612	1,257	3,506	17,869	6,811
Total.....	101,832	113,675	131,994	156,130	153,199	174,844	198,794	224,638	222,437	278,066	266,247	223,043

TABLE 57.—Exports of copper from Chile, short tons

Destination	1951				1952			
	Refined		Standard (blister)	Total	Refined		Standard (blister)	Total
	Electro- lytic	Fire- refined			Electro- lytic	Fire- refined		
Argentina.....								
Austria.....	55	402		457	1,246	16,480		17,726
Belgium.....		419		419				
Brazil.....	6,261	1,245		7,506	4,309	88		4,397
France.....	5,376	11,292		16,668		3,669	551	4,420
West Germany.....	115	3,349	5,520	8,984		1,404	11,459	12,963
Italy.....	5,173	1,023	10,626	16,822	7,543	364	9,713	17,620
Netherlands.....	83	66		139				
Spain.....						2,195		2,196
Sweden.....	4,742	13		4,755	22	551		573
Switzerland.....		924		924	220	650		870
United Kingdom.....		6,803	4,219	11,022		2,968	1,456	4,424
United States.....	106,335	113,878	43,980	264,193	130,748	133,951	56,314	321,013
Other.....	2,304	2,101	224	4,629	2,218	468		2,686
Total.....	130,444	141,505	64,569	336,518	146,306	162,988	70,493	388,787
Destination	1953				1954			
	Refined		Standard (blister)	Total	Refined		Standard (blister)	Total
	Electro- lytic	Fire- refined			Electro- lytic	Fire- refined		
Argentina.....						1,102		1,102
Austria.....								
Belgium.....					2,533			2,533
Brazil.....	2,379		165	2,544				
France.....	110			110	100			100
West Germany.....		323	11,791	12,114	4,646	276	15,063	20,015
Italy.....	4,575		168	4,743	11,234	56	10,299	21,589
Netherlands.....					17,075	112		17,187
Spain.....							7,984	7,984
Sweden.....					1,875			1,875
Switzerland.....						1,367		1,367
United Kingdom.....					53,107	15,850	5,096	74,053
United States.....	70,061	104,655	126,818	301,534	33,607	71,026	105,683	210,316
Other.....	55	20		75	3,512	169		3,681
Total.....	77,180	104,998	138,942	321,120	127,689	89,958	144,155	361,802
Destination	1955				1956			
	Refined		Standard (blister)	Total	Refined		Standard (blister)	Total
	Electro- lytic	Fire- refined			Electro- lytic	Fire- refined		
Argentina.....	2,205			2,205	2,203			2,203
Austria.....								
Belgium.....	1,427	56		1,483	224	45		224
Brazil.....	44	330		374				247
France.....	165			165	1,100	1,653		2,753
West Germany.....	9,314	4,867	26,499	40,680	17,635	3,516	27,293	48,444
Italy.....	18,833	667	15,643	35,143	6,594	5,924	7,008	19,526
Netherlands.....	29,721	409	392	30,522	30,010	2,417	1,427	33,854
Spain.....			1,764	1,764			4,960	4,960
Sweden.....	1,167			1,167				336
Switzerland.....	224	2,603		2,827		2,911		2,911
United Kingdom.....	49,855	39,387	7,941	97,183	40,366	40,378	783	81,525
United States.....	2,134	64,449	141,059	207,642	1,140	40,567	138,169	179,866
Other.....	3,304	504		3,808	1	84		85
Total.....	118,363	113,272	193,298	424,933	99,654	97,640	179,640	376,934

TABLE 57.—Exports of copper from Chile, short tons—Continued

Destination	1957				1958			
	Refined		Standard (bilster)	Total	Refined		Standard (bilster)	Total
	Electro-lytic	Fire-refined			Electro-lytic	Fire-refined		
Argentina.....	660			660				
Austria.....								
Belgium.....								
Brazil.....	32			32				
France.....	1,654	1,654		3,308				
West Germany.....	41,032	5,432	26,267	72,731	31,099	6,467	45,393	82,959
Italy.....	17,204	7,757	7,875	32,836	11,172	3,329	4,491	19,492
Netherlands.....	48,288	3,471	3,946	55,705	38,901			38,901
Spain.....			10,345	10,345			9,285	9,285
Sweden.....	11,248			11,248	8,778			8,778
Switzerland.....		2,941		2,941	132	3,877		4,009
United Kingdom.....	43,267	44,647	3,644	91,558	23,427	43,774	16,672	83,873
United States.....	4,376	4,238	207,530	216,144	61		200,116	200,427
Other.....	305	450		755	117	112		229
Total.....	168,166	70,590	259,427	498,183	118,687	58,309	275,957	447,953
Destination	1959				1960			
	Refined		Standard (bilster)	Total	Refined		Standard (bilster)	Total
	Electro-lytic	Fire-refined			Electro-lytic	Fire-refined		
Argentina.....	138			138				
Austria.....								
Belgium.....	2,326			2,326	1,260	1,456		2,716
Brazil.....								
France.....	6,671			6,671	16,590	276		16,866
West Germany.....	32,667	9,055	42,169	83,891	25,183	16,833	49,577	91,573
Italy.....	16,905	12,076	1,291	30,272	12,507	11,620	2,690	27,117
Netherlands.....	58,554	1,756	56	60,365	49,577	2,632		52,209
Spain.....			3,426	3,426				
Sweden.....	11,823			11,823	20,987	56	642	21,685
Switzerland.....		1,597		1,597				
United Kingdom.....	23,057	50,128	33,090	106,275	24,704	48,262	45,882	118,848
United States.....	13,993	2,804	201,417	218,214	600	1,251	201,999	203,850
Other.....	6	944		950				
Total.....	166,140	78,359	282,039	526,538	151,788	82,386	300,790	534,964
Destination	1961				1962			
	Refined		Standard (bilster)	Total	Refined		Standard (bilster)	Total
	Electro-lytic	Fire-refined			Electro-lytic	Fire-refined		
Argentina.....		460		460	3,208	1,174		4,382
Austria.....								
Belgium.....	924	3,250		4,174	111	2,273	8,618	11,002
Brazil.....		1,079		1,079	10,786	9,792		20,578
France.....	10,442	832		11,274	10,447	1,054		11,501
West Germany.....	22,766	17,395	46,795	86,957	27,732	12,562	39,358	79,652
Italy.....	11,872	12,273	1,498	25,643	16,570	19,448	771	36,789
Netherlands.....	67,384	3,792		71,176	52,297	3,419	84	55,800
Spain.....								
Sweden.....	22,871	604	2,405	25,880	24,182	1,513	2,104	27,799
Switzerland.....								
United Kingdom.....	25,536	34,736	52,938	113,210	36,021	28,316	44,841	109,178
United States.....	400	1,750	229,256	231,406	883		228,771	229,654
Other.....		1,243		1,243		3,010		3,010
Total.....	162,195	76,921	332,892	572,008	182,237	82,561	324,547	589,345

Republic of the Congo.—Belgium is the principal destination of copper from the Republic of the Congo. Except for 1959, France was second and Italy third. Table 58 shows substantial quantities shipped to the Beira and Lobito depots in 1959 and 1960. It is believed that most of this copper was shipped ultimately to Belgium.

Federation of Rhodesia and Nyasaland.—In all but 4 of the last 10 years, Rhodesia has exported more copper than any other country. The United Kingdom received most of the shipments; the United States was second from 1951 until 1958 when it was displaced by West Germany. Other European countries have

taken most of the remainder. Shipments by country of destination are given in table 59.

PRICES

U.S. copper prices are reported in terms of electrolytic copper, cents per pound, f.o.b. refinery, and cover the ordinary forms of wire bars and ingot bars. Small differentials exist for standard ingots, slabs, and billets, depending on dimensions and quality, and for cakes, depending on weight and dimensions. There is also a primary price of producers that before 1954 was quoted as-delivered-Connecticut Valley. In mid-1950, one producer began selling

TABLE 58.—*Exports of copper from Republic of the Congo, short tons*

Destination	1951	1952	1953	1954	1955
Algeria.....	2, 205	3, 307	3, 197	3, 386	3, 316
Australia.....	18, 638	4, 751			
Belgium.....	132, 267	131, 126	150, 558	159, 175	171, 465
France.....	34, 932	53, 780	37, 168	42, 846	41, 945
West Germany.....					56
India.....	2, 389	10, 453	3, 846	6, 534	2, 115
Italy.....	3, 401	13, 470	11, 336	10, 949	11, 690
Netherlands.....			748		
Republic of South Africa.....	6, 385	6, 548	3, 908	3, 422	5, 216
United Kingdom.....		66	4, 480	5, 638	5, 851
United States.....			7, 685	16, 362	13, 141
Beira Depot.....					
Lobito Depot.....					
Other.....	2, 286	2, 239	5, 379	1, 653	148
Total.....	202, 503	225, 740	228, 305	249, 965	254, 943
	1956	1957	1958	1959	1960 ¹
Algeria.....	1, 102	291			
Australia.....					
Belgium.....	187, 855	175, 097	173, 454	54, 057	38, 732
France.....	46, 414	41, 189	39, 389	34, 661	19, 072
West Germany.....	168	3, 365	89	4, 428	1, 254
India.....	1, 802	3, 205	1, 524		
Italy.....	14, 989	19, 365	22, 898	39, 684	15, 006
Netherlands.....	364	1, 896		5, 455	2, 976
Republic of South Africa.....	4, 508	6, 227	8, 631	8, 722	3, 845
United Kingdom.....	8, 007	3, 639	4, 518	3, 426	1, 680
United States.....	13, 929	11, 263	13, 390	5, 200	
Beira Depot.....				90, 863	47, 697
Lobito Depot.....				63, 445	33, 301
Other.....	494	1, 091	667	764	1, 213
Total.....	279, 632	266, 628	264, 560	310, 705	164, 776

¹ January–September.

copper priced as-delivered to United States consuming points; in 1954 other producers changed to this policy, and it became representative of the industry. Shipment costs were 0.125 cent per pound for American Metal Market quotations and 0.300 cent per pound for E&MJ Metal and Mineral Market prices. In 1957 the differentials between delivered and f.o.b. prices were increased to 0.175 and 0.400 cent per pound, respectively. Beginning with 1955 custom smelters of copper began quoting their price separately (table 60). Table 61 shows average weighted prices of domestic copper deliveries by selling agencies.

The U.S. price for copper in 1929 was the highest for any year after 1920, continuing high until April 1930. The price had been stabilized in April 1929 at 17.775 cents per pound by Copper Exporters, Inc. The worldwide industrial depression in 1930 brought a severe decline in copper consumption and a nearly compensating curtailment in production, but it did not prevent an increase in stocks. The price of copper fell from a little less than 18 cents in April 1930 to less than 10 cents in October, and in 1932 to the lowest average for all time—5.7 cents per pound. A tariff of 4 cents a pound was placed on imports effective June 21, 1932.

TABLE 59.—Exports of copper from Federation of Rhodesia and Nyasaland, short tons

Destination	1951				1952			
	Ore and concen- trate	Blister	Electro- lytic	Total	Ore and concen- trate	Blister	Electro- lytic	Total
Argentina.....								
Australia.....		3,363		3,363		5,936	4,648	10,584
Belgium.....		11,202		11,202		19,993	420	20,413
Brazil.....								
France.....		16,294		16,294		7,952		7,952
West Germany.....		392		392		560	672	1,232
India.....								
Italy.....								
Japan.....						3,125		3,125
Netherlands.....			13,309	13,309			14,410	14,410
Republic of South Africa.....								
Spain.....			16,801	16,801	6,761		15,006	21,767
Sweden.....			106	106				
Switzerland.....								
U.S.S.R.....		139,195	85,969	225,164		192,278	87,543	279,821
United Kingdom.....		38,866		38,866		27,294		27,294
United States.....			124	124		4	225	229
Other.....								
Total.....		209,312	118,309	325,621	6,761	257,142	122,924	386,827
Destination	1953				1954			
	Ore and concen- trate	Blister	Electro- lytic	Total	Ore and concen- trate	Blister	Electro- lytic	Total
Argentina.....							1,100	1,100
Australia.....							8,946	8,946
Belgium.....		10,917	4,900	15,817		2,073	1,511	3,584
Brazil.....								
France.....			3,497	3,497			6,802	6,802
West Germany.....		10,585		10,585		15,363	448	15,811
India.....		112	39	151		829	169	998
Italy.....			4,647	4,647			14,550	14,550
Japan.....								
Netherlands.....			336	336		4,699	3,785	8,484
Republic of South Africa.....			7,444	7,444		536	11,385	11,921
Spain.....								
Sweden.....			14,102	14,102			22,145	22,145
Switzerland.....						168	1,650	1,818
U.S.S.R.....		140,214	126,919	267,133		143,941	125,953	269,894
United Kingdom.....		86,580		86,580		62,165	1,232	63,397
United States.....		6,358	47	6,405		560	350	910
Other.....								
Total.....		254,766	161,931	416,697		230,334	200,026	430,360
Destination	1955				1956			
	Ore and concen- trate	Blister	Electro- lytic	Total	Ore and concen- trate	Blister	Electro- lytic	Total
Argentina.....			1,137	1,137			672	672
Australia.....							5,943	5,943
Belgium.....		1,303	4,259	5,562		1,170	2,184	3,354
Brazil.....							13,418	13,418
France.....		30	15,364	15,394			2,662	2,662
West Germany.....		21,413	2,290	23,703	461	25,457	6,362	28,580
India.....						1,284	7,636	8,920
Italy.....		336	11,585	11,921		2,505	14,158	16,663
Japan.....								
Netherlands.....		337	2,099	2,436	129		448	577
Republic of South Africa.....		115	10,546	10,661	45	728	15,033	15,806
Spain.....					5,073			5,073
Sweden.....			16,432	16,432		1,848	16,980	18,828
Switzerland.....			560	560			112	112
U.S.S.R.....								
United Kingdom.....		110,734	117,167	227,901		123,912	146,439	270,351
United States.....		59,350	7,277	66,627	1,452	14,003	16,210	17,665
Other.....		28	468	496			282	282
Total.....		193,646	189,174	382,820	7,396	170,907	240,893	419,169

TABLE 59.—Exports of copper from Federation of Rhodesia and Nyasaland, short tons—Continued

Destination	1957				1958			
	Ore and concentrate	Blister	Electrolytic	Total	Ore and concentrate	Blister	Electrolytic	Total
Argentina.....			5,893	5,893			9,743	9,743
Australia.....			1,681	1,681				
Belgium.....	1,627	56	7,088	8,771	1	101	8,124	8,226
Brazil.....			10,098	10,098			8,386	8,386
France.....		1,056	16,361	17,417		1,779	24,648	26,427
West Germany.....		39,914	7,674	47,588	5,601	35,788	10,420	51,809
India.....		1,687	24,944	26,631		2,265	22,764	25,029
Italy.....		2,847	10,225	12,772		448	11,789	12,237
Japan.....	2,498	2,128		4,626	1,333			1,333
Netherlands.....	8	7,396	7,941	15,345	8	5,905	11,455	17,406
Republic of South Africa.....	5,053	175	19,182	24,410	5,480	204	12,337	18,041
Spain.....	6,000	2,958		8,958		560		2,810
Sweden.....	20		14,450	14,470	2,262		17,512	19,774
Switzerland.....								
U.S.S.R.....								
United Kingdom.....		116,334	110,404	226,738		99,560	133,096	232,656
United States.....	880	17,558	29,683	48,121	732	15,594	17,926	34,242
Other.....			310	310		336	963	1,299
Total.....	16,086	191,709	265,934	473,729	17,667	162,530	287,123	467,320
Destination	1959				1960 ¹			
	Ore and concentrate	Blister	Electrolytic	Total	Ore and concentrate	Blister	Electrolytic	Total
Argentina.....			4,756	4,756			10,940	10,940
Australia.....			1,122	1,122				
Belgium.....	10,009	6,720	3,724	20,453		1,344	616	1,960
Brazil.....			3,371	3,371			4,669	4,669
France.....		402	21,021	21,423		140	22,249	22,389
West Germany.....		49,438	30,606	80,044		39,533	33,484	73,017
India.....		8,715	21,181	29,896		13,622	15,629	29,251
Italy.....		5,048	21,097	27,145		5,573	24,873	30,446
Japan.....	18,505		12,252	30,757	21,179		11,955	33,144
Netherlands.....		5,067	17,179	22,246			1,792	1,792
Republic of South Africa.....	6,756	194	8,827	15,577	4,129	328	9,329	13,786
Spain.....		2,489		2,489		582		582
Sweden.....	48		26,072	26,120	40	672	16,660	17,372
Switzerland.....		224	4,341	4,565		532	8,841	9,373
U.S.S.R.....		5,972	16,800	22,772		10,640	6,442	17,082
United Kingdom.....		78,770	188,159	266,929	910	55,980	134,815	191,705
United States.....		14,554	13,460	28,014			14,304	14,304
Other.....		816	2,541	3,357	240	1,456	8,577	10,273
Total.....	35,318	179,399	396,711	611,428	26,498	130,402	325,285	482,185

¹ January–September.

Prices continued low, almost without exception, until after World War II. Despite the strain on supplies of copper in 1941, large producers maintained a price of 12 cents for electrolytic copper delivered Connecticut Valley (11.87 f.o.b. refinery) until August 12, when a ceiling of 12 cents was established. In 1942 bonus payments for overquota production were established.

Ceiling prices were raised, effective June 3, 1946, to 14.375 cents per pound, delivered Connecticut Valley, and on November 10 all price controls were removed. The price rose immediately to 17.5 cents and by the end of the year to 19.5 cents, the highest since April 1929. Prices continued to advance in 1947 and into 1948; the excise tax was suspended in April 1947 and the Premium Price Plan was ended June 30, 1947.

The postwar period was one of continuing demand, except for part of 1949. An upsurge in prices followed the outbreak of hostilities in Korea in June 1950, and the quotation for electrolytic copper was 24.5 cents a pound at the

end of the year. The excise tax at 2 cents a pound was reimposed July 1, 1950—see the section on tariff. In 1951 the average quoted price was 24.5 cents a pound for electrolytic copper, delivered Connecticut Valley, the highest in any year since 1918. Ceiling prices were established by the General Ceiling Price Regulation effective January 26, 1951, at 24.5 cents, the price at which primary producers had been selling electrolytic copper.

Mobilization plans in foreign countries called for increased quantities of copper, and world consumption in 1951 was rising. Efforts of all countries to obtain sufficient supplies of metal led to increasing world prices. Rumors stated that prices up to 60 cents a pound were paid for copper on the European continent. The United States was unable to increase imports or even maintain them at the 1950 rate, and an agreement was made in May with Chile whereby an additional 3 cents more than the U.S. ceiling would be paid for Chilean copper sold in the United States. Later on, all copper refined from imported materials was paid for on the

TABLE 60.—*Monthly average copper prices of customer smelters, cents per pound, delivered*¹

Month	1955	1956	1957	1958	1959	1960	1961	1962
January.....	30.14	50.20	34.86	24.55	29.43	35.00	29.29	31.00
February.....	33.00	52.13	32.22	23.56	30.36	35.00	29.00	31.00
March.....	33.26	53.38	30.93	23.33	33.14	33.40	29.00	31.00
April.....	36.00	49.00	31.30	23.65	32.84	33.00	29.00	31.00
May.....	36.00	44.14	30.17	23.85	32.00	33.00	30.48	31.00
June.....	36.00	40.00	29.60	25.48	31.48	33.00	31.00	31.00
July.....	36.00	38.19	28.40	26.23	29.52	33.00	31.00	31.00
August.....	37.74	39.34	27.87	26.52	30.06	33.00	31.00	31.00
September.....	48.00	39.00	25.91	26.35	33.00	33.00	31.00	31.00
October.....	46.07	37.14	25.72	28.64	33.00	30.35	31.00	31.00
November.....	45.87	35.95	25.44	29.84	(?)	30.00	31.00	31.00
December.....	49.13	35.47	25.26	28.86	35.00	30.00	31.00	31.00
Average.....	38.93	42.83	28.97	25.91	31.48	32.65	30.31	31.00
High.....	50.25	54.50	35.00	30.00	35.00	35.00	31.00	31.00
Low.....	30.00	35.00	25.00	23.00	29.00	30.00	29.00	31.00

¹ Not reported separately before September 12, 1955.² Nominal.

Source: American Metal Market.

basis of 27.5 cents a pound. Maintenance-of-production contracts based on production costs were granted to avoid loss of production from high-cost mines, and additional sets of prices were established. Chile abrogated its agreement in May 1952 and embargoed exports to the United States. On May 21 importers were authorized to pay higher prices on foreign copper and to pass on to consumers 80 percent of costs above 27.5 cents, and shipments to the United States were resumed. Early in June the increases were permitted to be calculated at more than 24.5 cents instead of 27.5.

Supplies became more plentiful in 1953, and price controls were abandoned in February. By the end of April domestic and foreign prices, except Chilean, were each about 30 cents a pound. The price for Chilean copper from the three large U.S. mines was held, under Chilean Government direction, at 35.5 cents a pound in Chile—about 36.5 cents in the United States—until December. Despite accelerated rates of production in 1954 and 1955, the supply of copper was inadequate to meet increased demand. Gains in new productive capacity were offset by serious work stoppages in both years, and by August 1955 copper was quoted at 43 cents a pound—the highest in 90 years. Custom smelters, whose price was quoted separately for the first time in 1955, were quoting 50 cents a pound in September and 50.25 cents in December.

Prices continued to advance in 1956; by February primary producers were quoting 46 cents a pound, and custom-smelter quotations ranged from 50.5 to 51.5 cents; for a short time custom smelters quoted 55 cents. A downward trend began with a 4-cent decrease in late March and extended through early

July, when the price was 37.5 cents. Reduced prices abroad and the declining custom smelter price exerted pressure upon primary producers, and their price was lowered to 40 cents a pound by mid-July, the first reduction in more than two years. In the latter half of 1956 a slight slackening in industrial demand and a high rate of mine production indicated development of an oversupply, and the price was further reduced to 36 cents. At the end of the year custom smelters were quoting 35.5 to 36 cents.

Despite efforts by most copper producers in 1957 to bring supply in balance with demand by curtailed output, the industry was faced with oversupply throughout the year. In slightly more than seven months the producer price dropped from 36 cents to 27 cents, the lowest since February 1953. Custom-smelter prices declined also; by the end of 1957 the quotation was 25.5 cents. Fluctuations in prices in 1958 resulted in a 13-percent decrease in the annual average primary producer price. By late October producers were quoting 29 cents, and in late November custom smelters were on the 29-cent basis.

Operations at most of the principal copper properties were halted by the longest strike in history which began in August 1959 and continued into 1960. Mine production was the lowest annual total since 1949, and the price rose to 33 cents on November 12. This price held until October 12, 1960, when it fell 3 cents a pound to 30 cents. A custom smelter posted a 33-cent price on August 31 but withdrew the price on October 23 because of the strikes. About mid-March 1960 custom smelters established a 33-cent price, which was reduced to 31 cents on October 3 and to 30

TABLE 61.—Average yearly quoted prices of electrolytic copper, average weighted prices of refined copper delivered in the United States, including prices adjusted by the wholesale index, and for spot copper at London, cents per pound

Year	Electrolytic domestic f.o.b. refinery ¹	Electrolytic domestic f.o.b. refinery ²	Electrolytic export f.o.b. refinery ²	Refined copper		London spot copper ^{2,5}
				Weighted, f.o.b. refinery ³	Adjusted by wholesale index ⁴	
1926.....	13. 93	13. 795	(*)	14. 0	25. 5	14. 200
1927.....	13. 05	12. 920	(*)	13. 1	25. 0	13. 468
1928.....	14. 68	14. 570	(*)	14. 4	27. 2	15. 040
1929.....	18. 23	18. 107	(*)	17. 6	33. 8	18. 413
1930.....	13. 11	12. 982	(*)	13. 0	27. 5	13. 355
1931.....	8. 24	8. 116	(*)	9. 1	22. 8	8. 522
1932.....	5. 67	5. 555	(*)	6. 3	17. 7	5. 629
1933.....	7. 15	7. 025	6. 713	6. 4	17. 7	6. 877
1934.....	8. 53	8. 428	7. 271	8. 0	19. 5	7. 496
1935.....	8. 76	8. 649	7. 538	8. 3	18. 9	7. 753
1936.....	9. 58	9. 474	9. 230	9. 2	20. 8	9. 465
1937.....	13. 27	13. 167	13. 018	12. 1	25. 6	13. 097
1938.....	10. 10	10. 000	9. 695	9. 8	22. 8	9. 912
1939.....	11. 07	10. 965	10. 727	10. 4	24. 6	7 10. 066
1940.....	11. 40	11. 296	10. 770	11. 3	26. 3	(*)
1941.....	11. 87	11. 797	10. 901	11. 8	24. 7	(*)
1942.....	11. 87	11. 775	11. 684	11. 8	21. 9	(*)
1943.....	11. 87	11. 775	11. 700	11. 8	20. 9	(*)
1944.....	11. 87	11. 775	11. 700	11. 8	20. 7	(*)
1945.....	11. 87	11. 775	11. 700	11. 8	20. 4	(*)
1946.....	13. 92	13. 820	14. 791	14. 4	21. 8	(*)
1947.....	21. 15	20. 958	21. 624	20. 9	25. 7	(*)
1948.....	22. 20	22. 038	22. 348	21. 7	24. 7	(*)
1949.....	19. 36	19. 202	19. 421	19. 7	23. 6	(*)
1950.....	21. 46	21. 235	21. 549	20. 8	24. 0	(*)
1951.....	24. 37	24. 200	26. 258	24. 2	25. 0	(*)
1952.....	24. 37	24. 200	31. 746	24. 2	25. 7	(*)
1953.....	28. 92	28. 798	30. 845	28. 7	31. 0	(*)
1954.....	29. 82	29. 694	29. 889	29. 5	31. 8	10 31. 20
1955.....	37. 39	37. 491	39. 115	37. 3	40. 0	10 43. 83
1956.....	41. 88	41. 818	40. 434	42. 5	44. 2	10 41. 03
1957.....	29. 99	29. 576	27. 157	30. 1	30. 4	10 27. 36
1958.....	26. 13	25. 764	24. 123	26. 3	26. 2	10 24. 79
1959.....	30. 82	31. 182	28. 892	30. 7	30. 5	10 29. 80
1960.....	32. 16	32. 053	29. 894	32. 1	31. 9	10 30. 81
1961.....	30. 14	29. 921	27. 919	30. 0	29. 9	10 28. 73
1962.....	30. 82	30. 600	28. 514	30. 8	30. 6	10 29. 33

¹ American Metal Market.

² E&MJ Metal and Mineral Markets.

³ Reported by copper selling agencies. 1951-53 includes substantial quantity of copper sold delivered to consumers; beginning in 1954 all deliveries were made on that basis and the delivered price is reflected in averages shown.

⁴ Weighted price divided by Bureau of Labor Statistics wholesale price index (1947-49=100).

⁵ Based on average rates of exchange by Federal Reserve Board.

⁶ Not available. Export quotation established after imposition of tariff in 1932.

⁷ Average for 8 months; thereafter, London Metal Exchange dealings suspended.

⁸ No quotations.

⁹ London Metal Exchange trading resumed August 5, but official quotation not available.

¹⁰ Metal Bulletin (London).

cents on October 12. On May 19, 1961, the price of copper was established at 31 cents per pound, delivered, and remained at that level through 1962.

The average weighted price of copper deliveries reported by copper selling agencies covers copper produced in the United States and delivered here and abroad and copper produced abroad and delivered in the United States. It excludes copper both produced and delivered abroad and deliveries to domestic consumers. Also it excludes deliveries of foreign copper to Metals Reserve Co. and bonus

payments, applicable from February 1942 to June 30, 1947.

In the years immediately preceding World War II, London spot quotations of copper were slightly below those in the United States. Transactions on the London Metal Exchange (LME) were suspended at the outbreak of the war, and in December 1939 the price for electrolytic copper delivered was fixed by the British Ministry of Supply at £62 per long ton (12.29 cents per pound). Statutory maximum prices were revoked as of November 15, 1949.

Increases in the first half of 1950 raised the British price about 1 cent higher than the United States price. A £16 per ton drop in August, however, made the United Kingdom price temporarily lower than the U.S. price. On August 22 the price was £202 (25.25 cents). On August 23 the price dropped to £186 (23.25 cents) but the £202 quotation was reinstated effective September 1. By May 1951 the official maximum price was £234 (29.25 cents); a drop of £7 to £227 (28.375 cents) was announced in September by the British Ministry of Materials, which took over metal-purchasing functions from the Ministry of Supply in July.

In May 1952 the British Government began to base its selling price of metals and other raw materials on New York market prices plus a differential for freight, and other charges. By June 16 the official maximum price was £281 (35.125 cents), and on June 20 an agreement with producers was announced to purchase copper at 33 cents a pound. The British Ministry of Materials price was £285 (35.625 cents) on July 31, and British purchases from producers were 33.5 cents a pound f.a.s. New York, beginning August 1. Selling prices on the European Continent were reported to be about this level.

Free trading in copper on the London Metal Exchange was resumed August 5, 1953, after a lapse of nearly 14 years. The British Ministry of Metals continued to handle sales of copper until May 31, 1954. World supplies of copper temporarily failed to cover requirements in the second half of the year, and this, combined with the removal of the influence of the Government broker, caused widely fluctuating prices on the LME. The price rose to a record high in October—£310 per long ton (38.75 cents a pound). The British Ministry of Materials was dissolved August 16, and its remaining functions were transferred to the Board of Trade.

Prices on the LME substantially exceeded those in the United States throughout 1955. By August the price had reached £400 (50 cents), and in mid-December was a record high of £405 (50.625 cents); it dropped to 50 cents at the end of the month. On March 6, 1956, the price rose to a new record of £434 to £437 (54.25 to 54.625 cents). The price dropped the equivalent of 6 cents a pound in the latter part of March. Following a slight advance in August, prices dropped gradually to a monthly average of £273 (34.125 cents) in December 1956. By December 11, 1957, the price had dropped to £175 10s. (21.9 cents)—the lowest since June 5, 1950, when the Government-controlled price was £170 (21.25 cents). On November 6, 1958, following increases from February on, the LME price was £260 (32.5

cents). During the spring and summer of 1960 the price was equivalent to 30 or 31 cents a pound. Corresponding to the decrease in the U.S. price, the London price fell to the equivalent of 27.89 cents in October.

On May 6, 1955, the Roan Antelope Copper Mines, Ltd., and the Mufulira Copper Mines, Ltd., large copper producers in Northern Rhodesia, announced that effective May 9 they would offer copper at a fixed basic price of £280 a long ton (35 cents per pound), c.i.f. United Kingdom, to those of their consumers who were willing and able to instill a degree of stability into resale prices of copper and brass products. Prices were fixed for 30 days, then they were to be fixed for another definite period, and in June the Rhodesian Selection Trust Co., (RST) representing the two producers, announced that the price of £280 would continue, subject to change on 24 hours notice. In early September the RST price was raised to £360 (45 cents), and on February 27, 1956, to £385 (48.125 cents). This price held until April 30, when it was reduced to £350 (43.75 cents); it was further lowered to £320 (40 cents) on May 28, again on June 18 to £300 (37.5 cents), and on July 2 to £275 (34.375 cents). On August 1, the price was increased to £300 and reduced on October 15 to £280 (35 cents), which equaled the original price. Effective October 24, the price was cut to £265 (33.125 cents); rose to £280 on November 12; and was lowered to £270 (33.75 cents) on December 17. The RST continued to reduce the price in 1957; on February 1 to £250 (31.25 cents); February 19 to £240 (30 cents); June 17, £230 (28.75 cents); July 1, £220 (27.5 cents); August 12, £210 (26.25 cents); September 5, £200 (25 cents); and on September 19 to £190 (23.75 cents). The RST group announced that, effective October 7, it would price copper on the LME price basis; this changeover ended the dual pricing of Rhodesian copper that had been in effect for more than two years.

STOCKS

Producers stocks include refined copper, blister copper, and materials in process of refining (table 62). During the depression years of the 1930's when consumption was low, stocks of refined copper rose substantially. In the latter part of 1939 demand for copper increased due to war needs and stocks fell 47 percent by yearend. Requirements continued high during World War II, and stocks continued to decrease. Inventories rose 60 percent by the end of 1945 following the surrender of Germany in May and the collapse of Japanese resistance in August. Fears of a flood of war stocks from war-stimulated mines throughout the world,

TABLE 62.—*Stocks of copper at primary smelting and refining plants in the United States at end of year, short tons*

Year	Refined copper ¹	Blister and materials in process of refining ²	Year	Refined copper ¹	Blister and materials in process of refining ²	Year	Refined copper ¹	Blister and materials in process of refining ²
1926	73,000	227,500	1939	95,500	260,000	1952	26,000	185,000
1927	85,500	200,500	1940	91,500	243,000	1953	49,000	223,000
1928	57,000	211,500	1941	77,500	240,000	1954	25,000	189,000
1929	153,000	250,000	1942	84,000	235,500	1955	34,000	201,000
1930	307,500	225,000	1943	68,500	241,000	1956	78,000	261,000
1931	462,300	174,000	1944	81,000	311,000	1957	109,000	274,000
1932	502,000	189,000	1945	130,000	331,000	1958	48,000	257,000
1933	406,500	194,000	1946	96,000	254,000	1959	18,000	253,000
1934	284,500	194,500	1947	60,000	213,000	1960	98,000	261,000
1935	175,000	236,000	1948	67,000	183,000	1961	49,000	236,000
1936	110,000	195,500	1949	61,000	261,000	1962	71,000	246,000
1937	179,000	214,000	1950	26,000	232,000			
1938	181,000	233,000	1951	35,000	182,000			

¹ May include some copper refined from scrap.² Includes copper in transit from smelters in the United States to refineries therein.TABLE 63.—*Stocks of copper held by fabricators at end of year, short tons*

	1934	1935	1936	1937	1938	1939	1940
Stocks of refined copper ¹	296,439	309,352	334,143	362,115	323,439	300,543	339,376
Unfilled purchases of refined copper from producers.....	53,927	152,200	377,704	86,328	112,254	189,687	326,296
Total.....	350,366	461,552	711,847	448,443	435,693	490,230	665,645
Working stocks.....	151,921	151,346	190,248	203,664	182,465	184,833	240,740
Unfilled sales to customers.....	59,568	151,322	378,851	126,760	177,286	237,752	414,892
Total.....	211,489	302,668	569,099	330,424	359,751	422,585	655,632
Excess stocks over orders booked.....	138,877	158,884	142,748	118,019	75,942	67,645	10,013
	1941	1942	1943	1944	1945	1946	1947
Stocks of refined copper ¹	292,973	414,668	353,948	334,017	375,618	411,013	423,432
Unfilled purchases of refined copper from producers.....	241,335	135,481	90,807	53,538	44,100	59,421	103,765
Total.....	534,308	550,149	444,755	387,555	419,718	470,434	527,197
Working stocks.....	291,515	340,547	299,796	289,180	268,490	286,418	293,859
Unfilled sales to customers.....	547,468	613,005	465,258	285,654	362,436	526,643	338,260
Total.....	838,983	953,552	765,054	574,814	530,926	813,066	632,119
Excess stocks over orders booked.....	-304,675	-403,403	-320,299	-187,269	-211,203	-342,632	-104,922
	1948	1949	1950	1951	1952	1953	1954
Stocks of refined copper ¹	379,346	354,992	290,241	280,402	331,499	380,881	360,526
Unfilled purchases of refined copper from producers.....	81,496	82,793	92,372	32,147	32,662	25,022	58,125
Total.....	460,842	437,785	382,613	312,549	364,161	405,903	418,651
Working stocks.....	295,958	285,298	288,392	296,385	292,157	309,664	304,619
Unfilled sales to customers.....	315,944	189,407	313,032	303,050	275,608	170,917	136,681
Total.....	611,902	474,705	601,444	599,435	567,765	480,581	441,200
Excess stocks over orders booked.....	-151,060	-36,920	-218,831	-285,886	-203,614	-74,678	-22,549
	1955	1956	1957	1958	1959	1960	1961
Stocks of refined copper ¹	389,974	437,187	430,171	446,358	414,757	456,094	465,592
Unfilled purchases of refined copper from producers.....	139,094	117,601	75,627	90,401	130,324	75,222	81,297
Total.....	529,068	554,788	505,798	536,759	545,081	531,316	546,889
Working stocks.....	314,145	336,217	347,465	326,438	340,349	370,065	361,296
Unfilled sales to customers.....	293,264	183,834	138,631	177,869	202,775	126,260	144,344
Total.....	607,409	520,051	486,096	504,307	543,124	496,315	505,630
Excess stocks over orders booked.....	-78,341	34,737	19,702	32,452	1,957	35,001	46,367

¹ Includes in-process metal and primary fabricated shapes. Also includes small quantities of refined copper held at refineries for fabricators accounts.
Source: U.S. Copper Association.

TABLE 64.—*Consumer stocks of copper-base scrap at yearend, gross weight, short tons*

	1940	1941	1942	1943	1944	1945	1946		
Alloyed copper scrap.....	56, 283	57, 220	75, 111	56, 974	53, 456	57, 104	62, 622		
Low-grade scrap and residues.....	23, 733	34, 402	34, 924	34, 567	39, 686	37, 913	38, 813		
Unalloyed copper scrap.....	15, 606	15, 981	9, 235	10, 234	10, 660	16, 145	23, 034		
Total.....	95, 622	107, 603	119, 270	101, 775	103, 802	111, 162	124, 469		
	1947	1948	1949	1950	1951	1952	1953		
Alloyed copper scrap.....	72, 780	59, 924	46, 011	33, 518	39, 192	59, 470	84, 065		
Low-grade scrap and residues.....	66, 936	47, 574	34, 999	55, 778	16, 038	30, 787	55, 136		
Unalloyed copper scrap.....	15, 830	15, 241	12, 937	16, 521	10, 735	16, 448	17, 580		
Total.....	155, 546	122, 739	93, 947	105, 817	65, 965	106, 705	156, 781		
	1954	1955	1956	1957	1958	1959	1960	1961	1962
Alloyed copper scrap.....	67, 047	78, 328	65, 367	62, 077	71, 264	74, 315	60, 602	58, 257	65, 841
Low-grade scrap and residues.....	20, 993	49, 669	60, 322	40, 206	33, 067	67, 950	58, 133	33, 362	57, 411
Unalloyed copper scrap.....	19, 551	23, 524	24, 511	20, 659	25, 248	30, 452	27, 610	26, 990	28, 335
Total.....	107, 591	151, 521	150, 200	122, 942	129, 579	172, 717	146, 345	118, 609	151, 587

however, did not materialize. Demand in 1946 exceeded many expectations, and the supply from domestic sources fell short of capacity as a result of serious strikes in the copper industry. Consumption continued high through 1948. A reversal began in 1949 due to an industrial recession, and supply exceeded demand.

The recovery begun in the late months of 1949 continued into 1950 and was accelerated after the outbreak of war in Korea. Stocks of refined copper at the end of 1950 were the smallest they had been since 1906. The industry was faced then with inadequate supplies until 1954 when consumption declined, and more than enough copper was available for all needs. Four new properties came into production in 1954 but this new capacity was more than offset by labor strikes from August to October. Refined-copper stocks fell 49 percent to less than the 1950 quantity. In 1957 an oversupply developed, and stocks were higher than they had been since 1938. Voluntary cutbacks in output were begun in 1957 and continued in 1958. As a result of the 1959 strike, stocks of refined copper at yearend were 63 percent less than those at the beginning of the year and the lowest since before 1900. Settlement of the strikes and the return to near capacity output at primary refineries caused inventories to rise from April through December 1960.

Fabricators stocks of refined metals (includ-

ing in-process copper and primary fabricated shapes) are shown in table 63 for 1934 to 1962. The data show that stocks were insufficient to fill orders from 1941 through 1955; stocks failed to cover booked orders by a high of 403,000 tons in 1942 and a low of nearly 23,000 tons in 1954. By May 1956 the deficit was reduced to 1,800 tons and, thereafter fabricators reported stocks in excess of orders booked. The excess was less than 2,000 tons at the end of 1959 but rose to 45,000 tons at the end of 1961.

Consumers also maintain stocks of copper-base scrap which include unalloyed copper, copper-base alloy scrap, and low-grade scrap and residues. Total data for all consumers by these main categories are given in table 64 for 1940 to 1962.

During World War II, the Metals Reserve Company (MRC), a Reconstruction Finance Corporation subsidiary, maintained a stockpile of copper for emergency use (table 65). No copper remained in the MRC stockpile at the end of 1948, having been sold to industry or shipped to the strategic stockpile.

Inventories of refined copper in the United Kingdom are shown in table 66. Stock data for other countries are not available by individual countries, but total refined stocks outside the United States, published in Yearbooks of the American Bureau of Metal Statistics, are shown in table 67.

TABLE 65.—*Government stocks of copper, 1942–1962*

Yearend	Short tons	Yearend	Short tons
1942.....	91, 472	1953.....	661, 404
1943.....	224, 081	1954.....	860, 691
1944.....	412, 635	1955.....	884, 294
1945.....	565, 710	1956.....	931, 847
1946.....	92, 758	1957.....	1, 011, 391
1947.....	9, 986	1958.....	1, 136, 145
1948.....	(¹)	1959.....	1, 140, 591
1949.....	292, 005	1960.....	1, 146, 634
1950.....	531, 653	1961.....	1, 141, 579
1951.....	598, 876	1962.....	1, 134, 162
1952.....	553, 017		

¹ Not available.TABLE 66.—*Stocks of refined copper in the United Kingdom, short tons*

	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Consumers.....	32, 900	22, 000	23, 100	25, 400	36, 500	29, 000	31, 700	27, 300	25, 200	37, 500	38, 800	40, 100
LME warehouses.....			2, 300	1, 200	4, 000	4, 700	22, 700	6, 200	6, 000	16, 100	19, 100	14, 400
Other ¹	* 64, 900	* 80, 500	18, 300	24, 800	22, 900	17, 300	25, 000	22, 400	18, 000	54, 700	65, 300	88, 700
Total.....	97, 700	102, 500	41, 700	51, 400	63, 400	51, 000	79, 400	55, 900	49, 200	108, 300	123, 200	143, 200

¹ Government stocks included for 1951; thereafter they are excluded and the "Other" stocks are mainly stocks at ports, in transit to consumers in United Kingdom, and at refineries—except that stocks at consumer-operated refineries are included in consumer stocks.

* Includes wire rods.

Source: World Non-Ferrous Metals Statistics, the British Bureau of Non-Ferrous Statistics.

TABLE 67.—*Stocks of refined copper outside the United States, 1947–62*

Yearend	Short tons	Yearend	Short tons
1947.....	143, 979	1955.....	159, 777
1948.....	175, 669	1956.....	233, 775
1949.....	147, 972	1957.....	277, 316
1950.....	139, 919	1958.....	181, 822
1951.....	152, 203	1959.....	228, 243
1952.....	130, 103	1960.....	288, 510
1953.....	280, 530	1961.....	332, 479
1954.....	181, 529	1962.....	358, 856

CHAPTER 7.—STRUCTURE OF THE INDUSTRY

UNITED STATES COPPER INDUSTRY

The primary copper industry of the United States is composed of approximately 200 firms engaged in producing and selling copper. The major producers are vertically integrated and have mining, smelting, refining, fabricating, and marketing interests. Other large producers mine and have processing facilities through the smelting or refining stages, and many companies mine and concentrate their ores and ship the product to custom plants for smelting and refining. The principal operations of the industry in the United States are shown in table 68.

Location and Description

The copper producing areas are principally in the Western States. Arizona, in recent years, has led all other States in production by a wide margin. In 1962, Arizona supplied almost 52 percent of the U.S. total, and Utah was second with 18 percent—followed in descending order by Montana, New Mexico, Nevada, and Michigan. Arizona output comes from several important mines, whereas that of Utah comes from only one mine, the largest producer in the United States. Approximately 2 percent of the 1962 output was produced in eastern United States by three mines—one each in North Carolina, Pennsylvania, and Tennessee.

With the major copper mines centered in the Western States, most of the smelting capacity is in that area. There is some capacity in Michigan for the mines there, some on the east coast for eastern production and imports, and one smelter in Tennessee. Of the total annual smelting capacity of 8,847,000 tons, 8,165,000 tons is in the Western States, 515,000 tons is on the east coast and in Tennessee, and 167,000 tons is in Michigan.

Total refining capacity in the United States, electrolytic and fire-refined, amounted to 2,334,500 tons in 1962. The greater part of electrolytic refining capacity is on the Atlantic seaboard in New York, New Jersey, and Maryland. Low-cost power (so important to electrolytic refining), large nearby markets, and ocean transportation have combined to produce this concentration. Of a total electrolytic capacity of 1,963,500 tons, 1,129,000 is on the east coast,

792,000 tons is in the Western States, and 42,500 tons is in St. Louis, Mo. Fire refining capacity of 357,000 tons is in Michigan, Carteret, N.J., Hurley, N. Mex., and El Paso, Texas.

Mining.—In the United States, 360 mines produced copper in 1962. Copper ore was the principal product of 196 mines, and the others, mostly lead and zinc mines, produced copper as a byproduct or coproduct. The 25 largest mines accounted for 97 percent of the total domestic output; the top 5 mines produced 48 percent; and the leading 10 mines furnished 74 percent. Table 69 lists the 25 mines in order of 1962 output, and the principal producing companies with their 1962 production are given in table 70.

Smelting.—The primary copper-smelting companies, the locations of their smelters, and the approximate capacity of each plant (tons of charge) in 1962 are shown in Table 71.

Refining.—The primary copper refining companies and the location, type, and capacity of each refinery are shown in Table 72.

Fabrication.—Fabricators are the principal customers of the primary copper producers. It is in the fabricating plants that the bulk of the new copper is put into semifinished forms of sheet, strip, rod, tube, wire, and extruded and rolled shapes that constitute the raw materials for a vast industry of manufacturers of articles for final consumption or of parts for the products of other industries.

About 35 companies in the United States are recognized as the important fabricators and users of raw copper, the latter being, for the most part, the primary brass mills and wire mills. The larger fabricators, representing more than 50 percent of the total volume of business, are affiliated with the major copper producers, who thus have facilities for processing ores from the mines to the finished copper and brass products. Lists of affiliated and independent copper fabricating companies and associated producers are given on page 258.

Secondary Copper.—Old scrap is collected by several hundred scrap dealers who sell to secondary smelters, primary smelters, and brass mills. Secondary copper smelters use chiefly old copper-alloy scrap and make copper-alloy ingot; the metals remain in alloy form throughout the process. The ingot is used mostly by foundries. The various grades of copper scrap and copper-alloy scrap ordinarily sell at prices below the value of the constituent metals.

TABLE 68.—Principal copper producers in the United States and disposition of their copper, 1962

Operating company	Mine	Rank	Smelted by	Refined by	Sold by
American Smelting and Refining Company.	Mission.....	13	Own plant: Hayden, Ariz.....	Own plant: Perth Amboy, N.J.....	American Smelting and Refining Company.
The Anaconda Company.	Silver Bell.....	15	do.....	do.....	Anaconda Sales Co.
Appalachian Sulphides, Inc.	Butte Mines (Mont.).....	3	Own smelter: Anaconda, Mont.....	Own plant: Great Falls, Mont.....	Appalachian Sulphides, Inc.
	Yerington (Nev.).....	11	do.....	do.....	
	Ore Knob.....	25	White Pine Copper Co., (White Pine Mich.)	White Pine Copper Co., (White Pine, Mich.)	
Bagdad Copper Corp.	Bagdad.....	21	American Smelting and Refining Company (Hayden, Ariz.)	American Smelting and Refining Company (Perth Amboy, N.J.)	American Smelting and Refining Company.
Banner Mining Co.	(Daisy.....	24	do.....	do.....	
Calumet & Hecla, Inc.	Palo Verde.....	23			
	Calumet & Hecla.....	20	Calumet & Hecla, Inc. (Hubbell, Mich.)	Calumet & Hecla, Inc. (Hubbell, Mich.)	Calumet & Hecla, Inc.
Duval Sulphur & Potash Co.	Esperanza.....	14	American Smelting and Refining Company (Hayden, Ariz. and El Paso, Tex.)	American Smelting and Refining Company (Perth Amboy, N.J.)	American Smelting and Refining Company.
Inspiration Consolidated Copper Co.	Inspiration.....	10	Own smelter: Miami, Ariz.....	Own plant: Inspiration, Ariz. International Smelting and Refining Company, Raritan Copper Works (Perth Amboy, N.J.)	Anaconda Sales Co.
			Own smelters:	Own refineries:	
	Utah Copper (Utah).....	1	Garfield, Utah.....	Garfield, Utah.....	
	Chino (N. Mex.).....	5	Hurley, N. Mex.....	Hurley, N. Mex.....	
Kennecott Copper Corp.	Ray Pit (Ariz.).....	8	Hayden, Ariz.....	Kennecott Refining Corp. (Anne Arundel Co., Md.)	Kennecott Sales Corp.
	Liberty Pit (Nev.).....	12	McGill, Nev.....	American Smelting and Refining Company (Baltimore, Md.)	
Magma Copper Co.	Magma.....	18	Own plant: Superior, Ariz.....	Phelps Dodge Refining Corp.....	International Minerals & Metals Corp.
	San Manuel.....	4	San Manuel, Ariz.....	do.....	
			Own smelter:		
	Morenci (Ariz.).....	2	Morenci, Ariz.....	Phelps Dodge Refining Corp.....	Phelps Dodge Corp.
Phelps Dodge Corp.	New Cornelia (Ariz.).....	7	Ajo, Ariz.....	(El Paso, Tex.)	
	Copper Queen-Lavender Pit (Ariz.)	6	Douglas, Ariz.....	(Laurel Hill, L.I., N.Y.)	
Pima Mining Co.	Pima.....	17	American Smelting and Refining Company (Hayden, Ariz.)	American Metal Climax, Inc. (Carteret, N.J.)	American Metal Climax, Inc.
Tennessee Corp.	Copper Cities.....	16	Inspiration Consolidated, Copper Co. (Miami, Ariz.)	Raritan Copper Works & Phelps Dodge Refining Corp.	Adolph Lewisohn Selling Corp.
Miami Copper Co. Division	Miami.....	22	do.....	do.....	
Tennessee Copper Co. Division	Burra-Boyd.....	19	Own plant: Copperhill, Tenn.....	do.....	
White Pine Copper Co.	White Pine.....	9	Own smelter: White Pine, Mich.....	Own plant: White Pine, Mich.....	Copper Range Sales Co.

TABLE 69.—*Twenty-five leading copper-producing mines in the United States in 1962, order of output*

Rank	Mine	District or region	State	Operator	Source of copper
1	Utah Copper	West Mountain (Bingham)	Utah	Kennecott Copper Corp.	Copper ore.
2	Morenci	Copper Mountain (Morenci)	Arizona	Phelps Dodge Corp.	Copper, gold-silver ores.
3	Butte Mines (includes Kelley, Berkeley).	Summit Valley (Butte)	Montana	The Anaconda Company	Copper, silver-zinc ores.
4	San Manuel	Old Hat	Arizona	Magma Copper Co.	Copper ore.
5	Chino	Central	New Mexico	Kennecott Copper Corp.	Do.
6	Copper Queen-Lavender Pit	Warren (Bisbee)	Arizona	Phelps Dodge Corp.	Do.
7	New Cornelia	Ajo	do	do	Copper, gold-silver ores.
8	Ray Pit	Mineral Creek (Ray)	do	Kennecott Copper Corp.	Copper ore.
9	White Pine	Lake Superior	Michigan	White Pine Copper Co.	Do.
10	Inspiration	Globe-Miami	Arizona	Inspiration Consolidated Copper Co.	Do.
11	Yerington	Yerington	Nevada	The Anaconda Company	Do.
12	Liberty Pit	Robinson (Ely)	do	Kennecott Copper Corp.	Do.
13	Mission	Pima	Arizona	American Smelting and Refining Co.	Do.
14	Esperanza	do	do	Duval Sulphur & Potash Company	Do.
15	Silver Bell	Silver Bell	do	American Smelting and Refining Co.	Do.
16	Copper Cities	Globe-Miami	do	Tennessee Corp.	Do.
17	Pima	Pima	do	Pima Mining Co.	Do.
18	Magma	Pioneer (Superior)	do	Magma Copper Co.	Copper, gold-silver ores.
19	Copperhill	Polk County	Tennessee	Tennessee Copper Co.	Copper-zinc ore.
20	Calumet & Hecla, Inc.	Lake Superior	Michigan	Calumet & Hecla, Inc.	Copper ore and tailings.
21	Bagdad	Eureka (Bagdad)	Arizona	Bagdad Copper Corp.	Copper ore.
22	Miami	Globe-Miami	do	Tennessee Corp.	Copper precipitates.
23	Palo Verde	Pima	do	Banner Mining Co.	Copper ore.
24	Daisy	do	do	Pima Mining Co.	Do.
25	Ore Knob	Ashe County	North Carolina	Appalachian Sulphides, Inc.	Do.

TABLE 70.—*Principal copper producing companies in the United States, 1962*

Company	Mine production, short tons
American Smelting and Refining Company	65,008
The Anaconda Company	134,188
Bagdad Copper Corp.	11,056
Banner Mining Co.	10,765
Calumet & Hecla, Inc.	14,266
Duval Sulphur & Potash Co.	22,974
Inspiration Consolidated Copper Co.	52,291
Kennecott Copper Corp.	393,902
Magma Copper Co.	14,913
Phelps Dodge Corp.	265,779
Pima Mining Co.	19,700
San Manuel Copper Corp.	84,208
Tennessee Corp.-Miami Copper Division	28,793
White Pine Copper Co.	54,651

Source: American Bureau of Metal Statistics, 1962.

Secondary copper smelters produce a minor proportion of secondary refined copper; the remainder is the product of the primary smelters and refiners, which use scrap as well as primary raw materials. The other large group of scrap-metal consumers is the brass mills, which use chiefly new scrap generated in manufacturing articles from new sheet, tube, wire, and other brass-mill products. Much brass-mill scrap passes directly from the generators back to the mills from which the sheet and other shapes were purchased, without being handled by dealers. Certain quantities of brass-mill scrap customarily move through dealers, but since little or no preparation of

such material is necessary, the principal operation of the dealer consists in accumulating and sorting material from small manufacturers and fabricators and reselling it in quantities that can be conveniently handled by the brass mills.

Marketing

Mining produces ores that are milled to concentrates; concentrates are smelted to produce impure blister copper; refining eliminates impurities and produces copper conforming to established specifications; and fabricating produces sheet, strip, rod, bar, wire, tube, and shapes. Marketing is not a major operation until after the refining stage; however, firms engaged in only one or more of the processes preceding refining sell their product in the form made. Therefore, there are market transactions involving ores, concentrates, and blister copper, as well as refined metal.

Ores and Concentrates.—The majority of the copper-mining companies in the United States (producing about 25 percent of the annual output) do not have the smelters with which to treat the products of their mines. Large companies that include smelting in their operations or that are primarily engaged in the smelting business either purchase the ores and concentrates from these independent companies or treat them on toll. The practice of buying and treating ores and concentrates or of treating them on toll in a smelter is known as custom smelting.

Purchase of ores and concentrates is facilitated by a schedule, that is, a contract between the buyer and seller. The sale is affected by

TABLE 71.—United States primary copper smelters

Company	Location	Annual capacity
		<i>Short tons of charge</i>
American Metal Climax, Inc.....	Carteret, N.J.....	168,000
American Smelting & Refining Company.....	El Paso, Tex.....	420,000
Do.....	Hayden, Ariz.....	360,000
Do.....	Tacoma, Wash.....	600,000
The Anaconda Company.....	Anaconda, Mont.....	1,000,000
Inspiration Consolidated Copper Co.....	Miami, Ariz.....	360,000
Kennecott Copper Corp.:		
Nevada Mines Division.....	McGill, Nev.....	440,000
Chino Mines Division.....	Hurley, N. Mex. ¹	400,000
Ray Mines Division.....	Hayden, Ariz.....	400,000
Utah Mines Division.....	Garfield, Utah.....	1,225,000
Magma Copper Co.:		
Magma Division.....	Superior, Ariz.....	150,000
San Manuel Division.....	San Manuel, Ariz.....	360,000
Phelps Dodge Refining Corp.....	Laurel Hill, N.Y.....	² 200,000
Phelps Dodge Corp.:		
Douglas Reduction Works.....	Douglas, Ariz.....	1,250,000
Morenci Branch.....	Morenci, Ariz.....	900,000
New Cornelia Branch.....	Ajo, Ariz.....	300,000
Tennessee Copper Co.....	Copperhill, Tenn.....	90,000
Total.....		8,623,000
		<i>Tons of product</i>
Calumet & Hecla, Inc.....	Hubbell, Mich.....	100,000
Quincy Mining Co.....	Hancock, Mich.....	12,000
White Pine Copper Co.....	White Pine, Mich.....	65,000
Total.....		177,000

¹ Produces fire-refined copper as well as blister.² Closed August 1963.

Source: American Bureau of Metal Statistics, 1962.

local conditions as well as predetermined standards set down by the smelters. By utilizing this contract as a vehicle to obtain minimum and maximum quantities of ores and concentrates, the custom smelter assures itself of a relatively constant source of supply.

The contract specifies all conditions of settlement, such as the percentage of the total metal to be paid for, the basic smelting charge, penalties for impurities, bonuses for higher grade and time and rate of payment. As a general practice, a custom smelter purchases ores or concentrates outright and pays the producer the going rate after sampling and analyzing to determine the metal content. The contained metals then become the property of the smelter, which reduces, refines, and markets them under

what it considers the most favorable conditions. Ownership of metal recovered from ores or concentrates treated on a toll basis, is, however, retained by the original producer (mining company).

Often, although individual items in the schedules of individual smelters may vary considerably, the net return to the shipper is much the same under the several types of contracts. If a seller has a large quantity of material that can be supplied at a constant rate he will usually obtain a more favorable contract or schedule from the smelter to cover these transactions than he will for smaller quantities that are supplied at a less constant rate. For smaller shipments, smelters usually maintain a public or open schedule. Unless the shipper

TABLE 72.—United States primary copper refineries

Company	Location	Annual capacity refined copper, short tons
Electrolytic refineries		
American Metal Climax, Inc.....	Carteret, N.J.....	150, 000
American Smelting and Refining Company.....	Baltimore, Md.....	198, 000
	Perth Amboy, N.J.....	168, 000
	Tacoma, Wash.....	103, 000
The Anaconda Company.....	Great Falls, Mont.....	150, 000
Inspiration Consolidated Copper Co.....	Inspiration, Ariz.....	45, 000
International Smelting and Refining Co.....	Raritan, Perth Amboy, N.J.....	240, 000
Kennecott Copper Corp.....	Garfield, Utah.....	204, 000
Kennecott Refining Corp.....	Anne Arundel County, Md.....	198, 000
Cerro Copper & Brass Co., Division of Cerro Corp.....	St. Louis, Mo.....	42, 500
Phelps Dodge Refining Corp.....	El Paso, Tex.....	290, 000
Do.....	Laurel Hill, L.I., N.Y.....	175, 000
Total.....		1, 963, 500
Fire refineries		
American Metal Climax, Inc.....	Carteret, N.J.....	125, 000
Calumet & Hecla, Inc.....	Hubbell, Mich.....	60, 000
Kennecott Copper Corp.....	Hurley, N. Mex.....	84, 000
Quincy Mining Co.....	Hancock, Mich.....	12, 000
Phelps Dodge Refining Corp.....	El Paso, Tex.....	25, 000
White Pine Copper Co.....	White Pine, Mich.....	65, 000
Total.....		371, 000

Source: American Bureau of Metal Statistics, 1962.

has a separate contract, he is paid according to this open schedule.

The difference between the gross value of the marketable constituents of the ore as determined by analyses on the date of settlement, and the amount paid to the producer is made of two elements: (1) Smelting charges (including unavoidable metallurgical losses), and (2) marketing charges. The latter are definite charges against the ore that, for convenience, are paid by the smelter. Marketing charges usually include freight on ore from mine to smelter, demurrage, extra sampling costs and umpire assaying, freight to the refinery, and duties and customs charges if the ore is of foreign origin. The freight on metal to New York or to any other refinery point may be calculated as a separate item or may be pro-

vided for in the deduction from the metal quotation used for settlement. Under the first agreement, the seller gains or loses by changes in the freight rate. The cost of refining and marketing the refined metals, whether done by the smelter or by a separate company, usually is covered by an arbitrary deduction from the metal quotation and virtually becomes part of the smelting charge.

There are three principal smelting charges:

1. Nominal treatment charge, which often fluctuates with the value of the ore, the content of some constituent, or the market quotation for some constituent.
2. Deduction from the metal content (metallurgical losses usually covered here) or from the market quotations of the various salable metals.
3. Various penalties imposed because of the presence of undesirable constituents.

Fabricating Company:

	<i>Associated Copper Producers</i>
Chase Brass and Copper Co., Inc.	Kennecott Copper Corp.
The Okonite Co.	Do.
The Anaconda American Brass Co.	The Anaconda Co.
Anaconda Wire and Cable Co.	Do.
Phelps Dodge Copper Products Corp.	Phelps Dodge Corp.
Calumet & Hecla, Inc.-Wolverine Tube Division	Calumet & Helca, Inc.
C. G. Hussey & Co., Division Copper Range Co.	Copper Range Co.
New Haven Copper Co.	Tennessee Corp.
Cerro Copper & Brass Co., Division of Cerro Corp., St. Louis Works.	Cerro Corp.
Circle Wire and Cable Corp.	Do.

American Smelting & Refining Co. has substantial stock interests in General Cable Corp. (31.7 percent) and Revere Copper & Brass Co. (35 percent).

The more important fabricators not affiliated with the copper producers are:

Brass Mills:

	<i>Address</i>
Bohn Aluminum & Brass Corp.	1400 Lafayette Bldg., Detroit 26, Mich.
Bridgeport Brass Co., Division of National Distillers & Chemical Corp.	30 Grand Street, Bridgeport 2, Conn.
Bridgeport Rolling Mills Co.	Bridgeport 1, Conn.
The Bristol Brass Corp.	580 Broad Street, Bristol, Conn.
Chicago Extruded Metals Co.	1821 S. 54th Avenue, Cicero 50, Ill.
Detroit Gasket & Mfg. Co.	Belding, Mich.
The Electric Materials Co.	Clay & Washington Streets, North East, Pa.
International Silver Co.	500 S. Broad Street, Meriden, Conn.
Miller Co.	99 Center Street, Meriden, Conn.
Mueller Brass Co.	Port Huron, Mich.
New England Brass Co.	Taunton, Mass.
Olin Mathieson Chemical Corp.	Shamrock Street, East Alton, Ill.

H. K. Porter Co., Inc., Riverside-Alloy Metal Division. 1 Pavillion Avenue, Riverside, N.J.

Reading Tube Co., Division Progress Mfg. Co. Seventh & South Streets, Reading, Pa.

Scovill Mfg. Co. 99 Mill Street, Waterbury 20, Conn.

Triangle Conduit & Cable Co., Inc. Jersey Avenue, New Brunswick, N.J.

U.S. Mint Service. Washington 25, D.C.

Volco Brass & Copper Co. Kenilworth, N.J.

Western Electric Co., Inc. 222 Broadway, New York 38, N.Y.

Wire Mills:

Hatfield Wire & Cable Division, Continental Copper & Steel Industries, Inc. Hillside, N.J.

Rods, Inc. 23rd Street, Marion, Ind.

Rome Cable Corp. 332-400 Ride Street, Rome, N.Y.

Triangle Conduit & Cable Co., Inc. Jersey Avenue, New Brunswick, N.J.

Western Electric Co., Inc. 222 Broadway, New York 38, N.Y.

The principal secondary copper smelters in the United States in 1963 are:

Company:

	<i>Address</i>
Barth Smelting & Refining Co.	99-129 Chapel St., Newark 5, N.J.
Benjamin Harris & Co.	11th & State Sts., Chicago Heights, Ill.
W. J. Bullock, Inc.	Box 539, Fairfield, Ala.
Colonial Metals Co.	Second & Linden Sts., Columbia, Pa.
Elesco Smelting Corp.	3401 S. Lawndale Ave., Chicago 23, Ill.
Federal Metal Co.	7250 Division St., Bedford, Ohio.
Federated Metals Division, American Smelting & Refining Co.	120 Broadway, New York 5, N.Y.
George A. Avril Smelting Corp.	Este Ave. & B. & O. R.R., Cincinnati 32, Ohio.
H. Kramer & Co., including Ajax Metal Division	Frankford Ave. and Richmond St., Philadelphia, Pa.
I. Schumann & Co.	4391 Bradley Road, Cleveland 9, Ohio.
Interstate Smelting & Refining Co.	9651 S. Torrence Ave., Chicago 17, Ill.
Liberman & Gittlen Metal Co., Inc.	322 Front Ave., S.W., Grand Rapids 2, Mich.
Nassau Smelting & Refining Co.	1 Nassau Place, Tottenville 7, N.Y.
North American Smelting Co.	Marine Terminal, Wilmington 99, Del.
R. Lavin & Sons, Inc.	3426 S. Kedsie Ave., Chicago 23, Ill.
River Smelting & Refining Co.	P.O. Box 5755, Cleveland 1, Ohio.
Roessing Bronze Co.	Butler Plank Rd. (Etna), Pittsburgh 23, Pa.
North Chicago Refiners & Smelters, Inc.	2028 S. Sheridan Rd., N. Chicago, Ill.
Northwestern Metal Co.	9th & T Sts., Lincoln 1, Nebr.

The following is a typical schedule or contract for the purchase of copper ores and concentrates.

SCHEDULE OF PRICES, PENALTIES, AND DEDUCTIONS FOR A TYPICAL COPPER SMELTER

Charges:

Base treatment charge per ton. Ore: \$9.50 per short dry ton of ore based on a copper content of 12 percent or less. For each 1 percent that the copper content is in excess of 12 percent, increase the base charge by \$0.50 per short dry ton up to a maximum base charge of \$13.50 per short dry ton, fractions in proportion. Concentrates: \$13.50 per short dry ton of 2,000 pounds.

Handling charge per ton. Charge \$1.50 per ton for material received in bags or other containers.

Freight and advances. Seller shall reimburse buyer for freight paid and advances made to seller or for seller's account.

Payments:

Gold----- If .03 of a troy ounce per short dry ton or over, pay for 96.75 percent of the gold content at the net price realized by the U.S. Mint on the 15th day following the date of arrival of product at buyer's smelter.

Silver----- If one troy ounce per short dry ton or over, pay for 95 percent of the silver content at the Handy & Harman New York silver quotations, as published in the Engineering & Mining Journal, averaged for the calendar week following the date of arrival of product at buyer's plant. The amount of silver retained by buyer and not paid for will be a minimum of 1 troy ounce per short dry ton.

Copper----- Deduct from the wet assay 1.3 units and pay for 100 percent of the remaining copper at the daily net export refinery quotations for electrolytic wirebars, as published in the Engineering & Mining Journal, averaged for the calendar week following the date of arrival of product at buyer's smelter, less a deduction of \$0.03 per pound copper paid for. Nothing paid for copper if less than 1.3 percent by net assay.

No payment will be made for any metal or content except as above specified.

Penalties per ton of ore:

Arsenic----- Allow 1 percent free, charge for excess at \$1.00 per unit.

Antimony----- Allow 1 percent free, charge for excess at \$1.00 per unit.

Bismuth----- Allow .05 percent free, charge for excess at \$0.50 per unit.

Settlement:

Buyer will make 80 percent advance of the net estimated smelter value of product within 10 days after arrival at buyer's smelter. Buyer will make cash settlement on all shipments on the earliest practical date following the obtaining of all necessary information.

Refined Copper.—Copper fabricators provide the principal domestic market for refined copper produced in the United States. At times the brass-ingot makers are in the market for refined copper, but their needs usually are filled from the scrap market.

The market for refined copper in the United States consists of a limited number of buyers. Principal users are the fabricators affiliated with the large producers, the independent fabricators, and the large electrical manufacturers. The independent fabricators and electrical manufacturers buy directly from the large producers, their selling agents, and from time to time on the open market.

More than 60 percent of the copper delivered by the refineries is as wirebars. Cakes, cathodes, and billets make up the next largest groups, with about 10 percent each. Ingots, ingot bars, and other shapes comprise the remainder.

Copper usually is sold on 30- to 90-day deliveries from the refineries and priced during the month of shipment. Copper producers handle their transactions with the consumers through their sales agents which, in the case of the large producers, are usually subsidiaries or affiliated companies. American Metal Climax, Inc., and American Smelting and Refining Company, both custom smelters and refiners, are the principal independent selling organizations. Adolph Lewisohn Selling Corp., also is an important seller of copper, acting as the sales agent for the Tennessee Copper Co. Division and Miami Copper Co. Division of Tennessee Corp. Calumet & Hecla, Inc.; Copper Range Sales Co.; and International Minerals & Metals Corp. are other notable primary copper sellers. Table 73 shows the principal sellers and brands of copper sold in the United States.

Prices.—There are various price quotations for copper. In the United States, the three main ones are the U.S. producers price, the custom smelter price, and the Engineering & Mining Journal quoted price. There are also the New York Commodity Exchange price and the American Metal Market price. Copper prices are expressed in cents a pound and are quoted for the ordinary forms of wirebars and ingots; cathodes sell at a discount of 0.125 of a cent per pound, and small differentials exist for

TABLE 73.—*Principal sellers of copper in the United States and brands sold, 1962*

Selling agent	Sells copper for—	Brand	Type
American Metal Climax, Inc.	American Metal Climax, Inc.	D.R.W. ¹	Electrolytic.
	Chibuluma Mines Ltd.	AMCO ¹	Do.
	Cyprus Mines Corp.	OFHC	Do.
	International Nickel Co. of Canada, Ltd.	OFHC Certified	Do.
	Mazapil Copper Co.	AMPHOS	Do.
	Mulfulira Copper Mines, Ltd.	ORC ¹	Do.
	O'okiep Copper Co., Ltd.		Do.
	Pima Mining Co.	MCM	Do.
	Roan Antelope Mines, Ltd.	N.C.R. ¹	Do.
	Tsumeb Corp., Ltd.	AMCO RHC&R ¹	Fire-refined.
	American Smelting and Refining Company.	T ¹	Electrolytic.
	Banner Mining Co.	B.E.R. ¹	Do.
	Bagdad Copper Corp.	P.A. ¹	Do.
	Duval Sulphur & Potash Co.	I.S.A. ¹	Do.
	Lepanto Consolidated Mining Co, Ltd.	U.M.K. ¹	Do.
American Smelting and Refining Company.	Northern Peru Copper Corp.		
	Southern Peru Copper Corp.		
	Various		
	The Anaconda Company	B. & M. ¹	Electrolytic.
	Andes Copper Mining Co.	N.E.C.	Do.
Anaconda Sales Company	Compania Minera de Cananea S.A. de C.V.	N.E.C.	Do.
	Chile Exploration Co.	C.C.C. ¹	
	Inspiration Consolidated Copper Co.		
Calumet & Helca, Inc.	Calumet & Helca, Inc.	C. & H. ¹	Lake.
Cerro Sales Corp.	Cerro Corp.		Electrolytic.
Copper Range Sales Co.	Copper Range Co.	C.R. ¹	Lake.
International Minerals & Metals Corp.	White Pine Copper Co.		Do.
	Various	L.N.S. ¹	Electrolytic.
Kennecott Sales Corp.	Kennecott Copper Corp.	K.E.	Do.
	Braden Copper Co.	B.E.R. ¹	Do.
Adolph Lewisohn Selling Corp.		K.U.E. ¹	Do.
	Tennessee Copper Company Division	K.C.M.	Fire refined.
	Miami Copper Company, Division of Tennessee Corp.	L.N.S. ¹	Electrolytic.
		A.L.S. ¹	Do.
		N.E.C. ¹	Do.
Magma Copper Sales Corp.	Magma Copper Co., Magma Division		Do.
Phelps Dodge Corp. and Phelps Dodge Refining Corp.	Phelps Dodge Corp. and subsidiary companies; also custom.	P.D. & L.N.S. ¹	Do.
Quincy Mining Co.		P.D. & L.N.S. ¹	Do.
		D.D.M.	Fire refined.
		Q. & Q.M. Co. ¹	Lake.
Cerro Copper & Brass Co. Division Cerro Corp.	Cerro Copper & Brass Co. Division Cerro Corp.	L.M.C. ¹	Electrolytic.
Nassau Smelting & Refining Co.	Nassau Smelting & Refining Co.	N.H.E. ¹	Do.
		C.T.C.	Casting.
Reading Metals Refining Corp.	Reading Metals Refining Corp.	R.M.R.	Electrolytic.

¹ Approved brands for delivery against Commodity Exchange contracts.

Sources: American Metal Market, Metal Statistics 1962: pp. 317-319. American Bureau of Metal Statistics, Yearbook 1962, p. 23.

other refinery shapes. The producers price and the custom smelter price are set quotations, whereas the Engineering & Mining Journal price is a weighted average historical price, calculated for a day, week, month, or year based on sales reported by producers and their agencies.

The primary producers quotation is the most important as it covers the largest volume of metal. All the primary copper produced in the United States and that delivered in the

United States from U.S.-owned Chilean properties is marketed by the producers quotations. These prices are fixed with regard to interests of the companies for a long period.

The custom smelter price is governed by short-term supply-demand factors and, of course, fluctuates more frequently than the primary producers price. Custom smelters sell refined metal in ratio to ore intake to protect the difference between their buying and selling prices. This involves more frequent changes

in the custom smelter price, which on a falling market puts pressure on primary producers to lower their quotation.

The Engineering & Mining Journal quotations, domestic and foreign or export, are based on reported sales and reflect open market prices. Domestic prices are net at the refineries after the average shipment costs have been deducted. Foreign or export quotations are based on sales in the foreign market reduced to the f.o.b. refinery equivalent. The export quotation is calculated by reducing sales made c.i.f. Europe by the U.S. lighterage figure (0.125 cent a pound) and by the freight charged from the United States to the main European ports (0.82 cent a pound).

The New York Commodity Exchange (COMEX) prices are rarely, if ever, used as a pricing medium. COMEX, however, provides a facility for hedging as far ahead as twelve months and attracts some speculative business.

The American Metal Market price is the net price at New York refineries, derived by reducing the producers quotation by an average delivery cost (0.175 cent a pound).

Prices of copper scrap are quoted for numerous grades and specifications. Most scrap either is purchased directly by consumers, refined by the large primary refineries and marketed by them as refined copper, or is smelted and marketed as brass and bronze ingots by secondary producers. Quotations for such ingots bear no fixed relationship to the price of copper quoted by the large producers, as the content of alloying metals and supply-demand factors have a marked influence on ingot prices.

The international trade in copper is essentially based on three pricing systems: (1) The quotations published by the London Metal Exchange (referred to as the LME price), (2) the export quotations published by Engineering & Mining Journal (referred to as the E&MJ price), and (3) the quotations by Union Minière du Haut Katanga (often referred to as the Katanga quotation or the Belgian price).

The LME price and the Katanga quotation adequately reflect European copper prices. The London Metal Exchange offers each metal for a period of 5 minutes; offers and bids are made by interested parties until a satisfactory price is agreed upon. Copper is offered twice during the morning session and twice in the afternoon.

The London Metal Exchange was founded in 1881 and has dealt in copper since, except from 1939 to 1953. Briefly, its function is providing facilities for hedging rather than dealing in physical deliveries. In this respect, it is not a physical market place like those for certain other commodities but rather an exchange dealing on a standard contract and

concerned mainly with marginal quantities. Its facilities enable the buying and selling of copper for delivery on any of 1 to 90 days ahead.

The prices which the Exchange quotes daily are based either on the last transaction entered into or on the closing bids and offers made during the short period when dealings occur; the official LME prices thereby reflect dealings covering what may be only small tonnages of copper. However, these quotations are used for pricing infinitely greater quantities of copper on a direct producer-to-fabricator basis outside the Exchange. These producers and fabricators adopt the official LME quotations as their pricing basis in the same way one might use official stock exchange quotations for a private share deal. This mechanism creates an ultra-sensitive market, and some times prices fluctuate violently from day to day.

Fabricators of copper-base products often trade in copper on the LME to protect themselves against loss due to price fluctuations.

The Katanga quotation is a price fixed unilaterally by the Union Minière du Haut Katanga in relation to its view of current market conditions and trends. One of the objectives of this organization has been to bring more stability into the market. The same price is quoted for f.o.b. Antwerp and c.i.f. New York.

E&MJ Metal and Mineral Markets is published weekly on Thursdays, and the daily prices shown are for the preceding week and cannot be used for day-to-day sales. However, these prices are useful for making average-price contracts because they reflect the prices at which much of the international trade in copper was conducted.

Cartels.—Several organized efforts at price control in the copper industry have been made since the 1880's. An early and spectacular attempt known as the Secretan corner was organized and financed in Europe in the autumn of 1887; it temporarily succeeded in more than doubling the price of copper. However, the syndicate in charge was unable to maintain this level in the face of bitter consumer resistance and in competition with the flood of new and scrap copper that poured into the market; in the spring of 1889 the enterprise ended disastrously.

Ten years later, the Amalgamated Pool—organized by U.S. mining and financial interests and supported by most foreign producers—for a time was able to raise the price of copper and hold it well above its former level. But again, the high price resulted in decreased consumption, increased offerings of scrap, and an unexpected increase in output from independent producers. There was a severe price decline

in 1901, but this time a crash was avoided by the receipt of financial aid from London. By 1906, the Amalgamated group again felt strong enough to force up the price of copper. Once more, however, the success was short lived, coming to an end during the financial panic of 1907.

One concerted effort to control the copper price has been generally judged a success. This was a combination including practically all U.S. producers formed into the Copper Export Association. It was organized in December 1918 under the authority of the Webb-Pomerene Act, having three large companies acting as leaders to deal with the problems that confronted the industry after World War I. Large stocks of new metal had piled up, and millions of tons of recoverable scrap littered the battlefields of Europe. In addition surplus production capacity, developed during the war, threatened to become an important factor in price cutting. Suspension of government price control and government buying shifted attention from the problem of production to one of markets.

Under control of the newly-organized Association, production was curtailed, particularly during the depression of 1921; the war surplus of new and scrap metal was liquidated, and—in line with the provisions of the Webb-Pomerene Act—foreign orders were prorated among the organization members. But after accomplishing the purpose for which it had been organized, the Association was unable to extend its harmonious existence. Companies purely domestic in character and those with important foreign holdings were unable to agree regarding the future policy of the organization. Accordingly, the Association was disbanded in 1923, following the withdrawal of the Guggenheim interests and their affiliates, representing at that time 45 percent of the U.S. output.

Organization of Copper Exporters, Inc., in October 1926, marked the beginning of another unsuccessful attempt at price control. This group, under the leadership of the large U.S. companies, accounted for 95 percent of the world production. At this time, the copper industry was in a favorable position, and U.S. interests were by far the most important factors in the industry; stocks were at reasonably low levels, and demand was rising sharply. However, producers charged that harmful speculation by brokers caused wide fluctuation in price. Therefore, when the cartel was formed it announced that it planned to bypass these brokers and sell directly to consumers at prices to be fixed daily in accordance with general business conditions.

For a year and a half the cartel operated to the apparent satisfaction of consumers, and with an actual small decline in price. Then it adopted a different policy—one that eventually lost to U.S. producers the control they previously had over the industry.

In late 1928 and early 1929 European consumers, principally copper fabricators, were rationed almost from day to day. In their efforts to obtain the metal required to meet their own commitments, these buyers bid up the price—a cent a day in March 1929—until, at 24 cents a pound, a buyers strike began. The detailed story of subsequent events is long—involving the antagonism of European consumers; the efforts made to protect the fabricators interests; the struggle to withstand the inevitable price decline; the expansion of competitive capacity in Northern Rhodesia, Belgian Congo, and Canada; the substitution of aluminum for copper in substantial amounts; the usual increase in offerings of scrap; and, eventually, drastic reductions in domestic output in 1931 and 1932. Finally, after the United States raised a tariff wall against copper imports in June 1932, four of the most important foreign producers withdrew from the cartel.

In 1935 a new cartel was formed, its membership representing producers of about 50 percent of the copper then being mined in countries outside the United States, Canada, Russia, and Japan. The cartel was formed to adjust production of its members to meet consumption requirements outside the United States. There was no participation by United States or Canadian producers.

During its relatively short life, this cartel alternately tightened and relaxed its restriction on the industry. During the first year, for example, the output of the group was cut to roughly 70 percent of theoretical capacity. Expanding consumption in 1935 brought a corresponding increase in quotas and some expansion in output. In 1937, restrictions were again tightened. Thereafter, production pressed hard against the limits imposed by the cartel, until the outbreak of war in September 1939 brought to an end the whole cooperative arrangement.

Physical and Financial Corporate Structure by Companies

On the following pages are descriptions and pertinent data regarding those companies engaged in mining, smelting, and refining. The information has been compiled from published sources such as company reports, Skinner's

Mining Yearbook (1960), Moody's Industrial Manual (1961), and reputable trade publications, together with information from government sources that has been released for administrative use. It has not been possible to describe each company and operation with the desired detail and accuracy because (1) there are differing policies regarding release of information, (2) some of the available information is conflicting, and (3) better information is available about some companies than about others.

The larger copper producing corporations are vertically integrated, in greater or lesser degree, from mines through smelting, refining, fabricating, and marketing. Some of them have interests in foreign operations, many produce metals other than copper, and some have diversified industrial interests. Where possible, descriptions of the various companies include references to all affairs in which they participate. Some of the references are not as complete as in others owing to the lack of similar information in source material.

American Metal Climax, Inc.—1270 Avenue of The Americas, New York 20.—American Metal Co., Ltd. (incorporated 1887) was organized by Metallgesellschaft of Frankfurt-on-the-Main and Henry R. Merton and Company, Ltd., of London. Management of the company was undertaken by men previously connected with Metallgesellschaft. The company grew rapidly and developed from a purely trading concern into a factor in the mining and smelting industry in the United States and Mexico.

World War I forced a dissolution of the relationship with Metallgesellschaft and Henry R. Merton and Company, and in 1920 the Metallgesellschaft shares were sold to U.S. investors. In conjunction with this sale L. Vogelstein and Company was consolidated with American Metal Company.

In 1928, the company acquired its first interest in the Rhodesian copper mines, an interest that had grown tremendously by 1960.

On December 31, 1957, American Metal Co., Ltd., and Climax Molybdenum Co. merged under the name American Metal Climax, Inc. The corporation is both a holding and operating concern engaged in mining, metallurgical, and petroleum enterprises through subsidiaries and stock interests in many companies. Industrial operations of the subsidiaries are principally in the United States, Mexico, and Northern Rhodesia, but metal-trading activities are virtually worldwide.

The principal products and byproducts are copper, copper-powder, gold, silver, palladium, platinum, selenium, tellurium, and arsenic; lead, lead powder, solder, ferrous metal, zinc, cadmium, bismuth, and germanium; molybdenum sulfide (concentrates), molybdenum trioxide, calcium molybdate, molybdenum, and ferromolybdenum; and potash, uranium, vanadium, and iron powder.

The subsidiaries and affiliated companies involved in production of copper are:

(1) United States Metals Refining Co., a wholly owned subsidiary, operating a copper smelter and refinery at Carteret, N.J., which produces refined copper from domestic and foreign ores, concentrates, blister,

copper, and copper scrap. The total annual refining capacity of 275,000 short tons consists of 150,000 tons of electrolytic capacity and 121,000 tons of fire-refining capacity. This company is the only domestic producer of commercial oxygen-free high-conductivity (OFHC) copper in refinery shapes (wirebars, billets, cakes), producing between 30,000 and 35,000 tons of these shapes per year.

(2) Rhodesian Selection Trust, Inc., 50.60 percent owned, a holding company controlling Mufulira Copper Mines, Ltd., and Chibuluma Mines, Ltd., operating mines, a smelter, and a refinery in Northern Rhodesia.

(3) Roan Antelope Copper Mines, Ltd., 32.65 percent owned, operates a mine and smelter and has two-thirds interest in Ndola Copper Refineries, Ltd., which has an electrolytic refinery at Ndola, Northern Rhodesia, having an annual capacity of 121,000 short tons of refined copper.

(4) Tsumeb Corporation, Ltd., 29.13 percent owned, mines a rich complex ore containing lead, copper, and zinc, with important values of cadmium, silver, and germanium. The mine is in the Grootfontein district of South-West Africa. A copper smelter under construction is scheduled for completion in 1962.

(5) O'okiep Copper Company, Ltd., 19.72 percent owned, operates several mines and a smelter in Namaqualand, Cape Province, Republic of South Africa. O'okiep owns 9.5 percent of Tsumeb Corporation, Ltd.

Other enterprises in which American Metal Climax, Inc. has substantial interests are:

Companies 100 percent owned:

Amax Sales Co. of Canada, Ltd.
American Climax Petroleum Corp.
Ametal, S.A., Switzerland.
Blackwell Zinc Co., Inc.
Climax Molybdenum Co. of Michigan.
Climax Uranium Co.; unit, merged 1961.
Southwest Potash Corp.
The American Metal Co. of Canada.
The Anglo Metal Co., Ltd., England.
The South American Metal Co., Chile.

Companies less than 100 percent owned:

	Percent
American Lithium Chemicals, Inc.	18. 22
Bikita Minerals (Private), Ltd.	21. 25
Cerro Corp.	1. 54
Copper Range Company	17. 49
Heath Steele Mines, Ltd., Canada; mine inactive	75. 00
Metalurgia Mexicana Penoles, S.A., Metmax Penoles	49. 00
San Antonio Chemicals, Inc.	18. 22
San Francisco Mines of Mexico, Ltd.	37. 69
The Mazapil Copper Company, Ltd.	29. 41

There are also several other wholly owned but separately incorporated sales, exploration, and service organizations in the United States, Canada, Mexico, and Europe.

Capitalization:

4½ percent cumulative preferred stock—authorized 127,692 shares, outstanding 70,610 shares. Common stock—authorized 20,000,000 shares, outstanding 14,184,634, December 31, 1960.

Assets and liabilities:

December 31, 1960—total current assets, \$180,189,819; total current liabilities, \$62,325,782.

Sales of nonferrous and precious metals:

	1958	1959	1960
Copper..... tons..	\$531, 000	\$627, 000	\$586, 000
Lead..... do.....	242, 000	245, 000	232, 000
Zinc..... do.....	172, 000	169, 000	180, 000
Tin..... do.....	15, 000	15, 000	14, 000
Silver..... ounces..	42, 132, 000	39, 854, 000	40, 385, 000
Gold..... do.....	867, 000	664, 000	546, 000

Production of ferrous metals:

Molybdenum.....	25, 079, 000	36, 556, 000	49, 631, 000
Tungsten.....	435, 000	890, 000	975, 000

Sales of uranium and vanadium.....

8, 282, 000 7, 649, 000

Employees:

December 31, 1960, 9,300, of whom 3,000 were outside the United States, chiefly in Mexico.

American Smelting and Refining Company.—120 Broadway, New York 5.—Incorporated in New Jersey, April 4, 1899, consolidating a number of mines, smelters, and refineries. The company and subsidiaries are primarily engaged in custom smelting and refining nonferrous mineral commodities and in selling refined metals. In addition, the company operates owned, leased, and managed mines; buys and processes nonferrous scrap and sells secondary metals; and mines coal and produces coke, principally for company use. In 1960 the company operated copper, lead, and zinc smelters and refineries with refined metal capacities of 480,000 tons of copper, 528,000 tons of lead, and 214,000 tons of zinc annually. It also operates cadmium plants at Corpus Christi, Tex., and Denver, Colo.; a zinc dust plant at Sand Springs, Okla.; and sulfuric acid plants at Selby, Calif., Tacoma, Wash., Corpus Christi, Tex., and San Luis Potosi, Mexico. It also has lead-fabricating plants at Selby and San Francisco, Calif., Barber, N.J., and Houston, Tex. It recovers arsenic as a byproduct at the Tacoma and San Luis Potosi plants.

Principal products produced include: Copper, lead, zinc, gold, silver, antimony, arsenic, bismuth, cadmium, germanium, selenium, tellurium, asbestos, fluorspar, indium, coal and coke, zinc dust, zinc sulfate, copper sulfate, nickel salts, sulfuric acid, mixed and semi-fabricated metals (aluminum, brass, and copper ingots, babbitts, special alloys, tin products, etc.), and fabricated lead products.

The company owns or has controlling interest in the following subsidiaries, as well as lesser holdings in many other operations:

Companies 100 percent owned:

Ardeo, Inc.
 Asarco Exploration Co. of Canada, Ltd.
 Asarco International Corp.
 Asarco Mercantile Co., Tex.
 Compania American Smelting, S.A., Chile.
 Compania American Smelting Boliviana, S.A.
 Compania Minera Asarco, S.A., Mexico.
 Compania de Terrenos e Inversiones de San Luis Potosi, S.A., Mexico.
 Compania Minera y Beneficiadora de San Antonio y Anexas, S.A., Mexico.
 Federal Mining & Smelting Co.; inactive.
 Federated Metals Canada, Ltd.
 Federated Metals Corp., Pa.; inactive.
 Great Western Smelting & Refining Co.; inactive.
 Incar, Inc.
 International Metal Co., N.Y.
 Lake Asbestos of Quebec, Ltd., Del.

Companies 100 percent owned—Continued

Lone Star Lead Construction Corp., N.Y.
 Mines Trading Co., Ltd., England.
 Northern Peru Mining Corp., Peru.
 Union Smelting and Refining Co., N.Y.; inactive.

Companies less than 100 percent owned:

	Percent
Alta Mining and Development Co., Utah..	62. 4
Blackhawk Mining and Development Co., Ltd.....	99. 7
Compania Metalurgical Mexicana.....	60. 3
Compania Minera de Jesus Maria, S.A., Mexico.....	77. 9
Fairview Mining Co., Ltd., Canada.....	78. 0
Garfield Chemical & Manufacturing Corp., N.Y.....	50. 0
Government Gulch Mining Co., Ltd., Idaho.....	72. 4
Green Hill Cleveland Mining Co., Nev.....	50. 0
Liard River Mining Co., Ltd., Canada.....	70. 0
Mount Isa Mines, Ltd., Australia.....	53. 8
Neptune Gold Mining Co.....	51. 8
Sociedad Minera Milluschaqui, Ltd.....	94. 0
Southern Peru Copper Corp.....	51. 5
Southern Peru Copper Sales Corp.....	51. 5
Wyoming Mining & Milling Co., Idaho.....	95. 6

The company and/or subsidiaries have various stockholdings in other corporations (in which company denies any effective control) among which are:

Company:

	Percent owned
Compania Minera de Osidro y Anexas, S.A., Mexico.....	49. 0
General Cable Corp.....	31. 5
Revere Copper & Brass, Inc.....	35. 0
United Park City Mines Co.....	9. 8
Kennecott Copper Corp.....	0. 9
Zinc Industrial, S.A., Mexico.....	50. 0

Capitalization:

Preferred stock (7 percent cumulative preferred par \$100) authorized and outstanding 500,000 shares. Common stock, authorized 8,000,000 shares; outstanding Dec. 31, 1960, 5,446,602 shares; reserved for option, 108,200 shares; no par.

Assets and liabilities:

December 31, 1960; total current assets \$200,842,000; total current liabilities \$66,014,000; net current assets \$134,828,000.

Employees:

As of December 31, 1959, 25,729.

Metal content of concentrates and shipping ore

Mine production:

Year:	Tons ore mined	Tons copper	Tons lead	Tons zinc	Ounces gold	Ounces silver
1951.....	2, 453, 071	16, 568	98, 318	159, 119	35, 429	11, 193, 029
1955.....	5, 828, 133	40, 091	107, 524	187, 704	57, 755	13, 331, 536
1960.....	5, 292, 768	41, 531	86, 335	159, 743	28, 270	11, 706, 526

Refinery production:

Year:	Tons copper	Tons lead	Tons zinc	Tons other zinc ¹	Ounces gold	Ounces silver
1951.....	414, 226	503, 851	146, 588	116, 984	1, 196, 096	72, 370, 258
1955.....	353, 554	459, 789	186, 436	132, 986	1, 006, 183	72, 646, 739
1960.....	433, 111	387, 564	201, 694	119, 317	940, 421	95, 401, 945

¹ Zinc content of zinc concentrates, zinc dust, zinc fume, and slag shipped to others.

Mines in the United States:

Galena Unit.—Wallace, Idaho—silver, copper, lead, zinc.
Ground Hog Mine.—Vanadium, N.M.—silver, lead, zinc; operations suspended.
Jack Waite Mining Co.—Duthie, Idaho—silver, lead, zinc.
Keystone Unit.—Crested Butte, Colo.—silver, lead, zinc; operations suspended.
Mission Mine.—Near Tucson, Ariz.—copper.
Page Unit.—Kellogg, Idaho—silver, lead, zinc.
Silver Bell Unit.—Near Tucson, Ariz.—copper.

Mines in Mexico:

Charcas Unit.—Charcas, San Luis Potosi, Mexico—silver, copper, lead, zinc.
Concepcion del Oro Unit.—Zacatecas, Mexico—copper.
Encantada Unit.—Agujita, Coahuila, Mexico—fluorspar.
Montezuma Lead Co.—Santa Barbara, Chihuahua, Mexico—gold, silver, copper, lead, zinc; owned by Cia Metalurgica Mexicana.
Nuestra Senora Unit.—Cosalo, Sinaloa, Mexico—lead, zinc, silver.
Parral Mines.—Parral, Chihuahua, Mexico—gold, silver, copper, lead, zinc.
Plomosos Mines.—Picachos, Chihuahua, Mexico—silver, lead, zinc.
Rosita, Agumita, and Cloete Mines.—Near Rosita, Coahuila, Mexico—coal and coke.
San Martin Unit.—Sombretete, Zacatecas, Mexico—silver, copper, lead, zinc.
Santa Barbara Mine.—Santa Barbara, Chihuahua, Mexico—gold, silver, copper, lead, zinc.
Santa Eulalia Mines.—Santa Eulalia, Chihuahua, Mexico—silver, lead, zinc.
Taxco Mine.—Taxco, Guerrero, Mexico—gold, silver, lead, zinc.
Vesper Unit.—Parral, Chihuahua, Mexico—silver, lead, zinc.

Mines in Other Foreign Countries:

Buchans Mine.—Buchans, Newfoundland, Canada—lead, zinc, copper, gold, silver.
Lake Asbestos of Quebec, Ltd.—Black Lake, Quebec, Canada—asbestos fibre; capacity approximately 100,000 tons per year.
Mt. Isa Mines, Ltd.—Mt. Isa, Queensland, Australia—silver, copper, lead, zinc.
Neptune Gold Mining Co.—Bonanza, Nicaragua—gold.
Northern Peru Mining Co.—Trujillo, Peru—copper, zinc, lead, gold, silver.
Southern Peru Copper Corp.—Toquepala mine, Peru—copper.

Smelters:

Location:

	Capacity, tons of charge		
	Copper	Lead	Zinc
Mt. Isa, Australia ¹	470, 000	165, 000	-----
El Paso, Tex.	420, 000	360, 000	-----
Hayden, Ariz.	360, 000	-----	-----
Tacoma, Wash.	600, 000	-----	-----
San Luis Potosi, Mexico	300, 000 ²	300, 000	-----
Ilo, Peru ³	500, 000	-----	-----
East Helena, Mont.	-----	360, 000	-----
Selby, Calif.	-----	192, 000	-----
Chihuahua, Mexico	-----	500, 000	-----
Amarillo, Tex.	-----	-----	100, 000
Rosita, Mexico	-----	-----	120, 000
Corpus Christi, Tex.	-----	-----	165, 000

¹ Owned by Mt. Isa Mines, Ltd.² Operations discontinued August 1959.³ Owned by Southern Peru Copper Corp.

Refineries:

Location:

	Capacity, tons per year		
	Copper	Lead	Zinc
Perth Amboy, N.J.	168, 000	96, 000	-----
Baltimore, Md.	198, 000	-----	-----
Tacoma, Wash.	114, 000	-----	-----
Omaha, Nebr.	-----	180, 000	-----
Selby, Calif.	-----	72, 000	-----
Monterey, Mexico	-----	180, 000	-----
Amarillo, Tex.	-----	-----	49, 000
Corpus Christi, Tex.	-----	-----	105, 000
Rosita, Mexico	-----	-----	60, 000
Townsville, Australia ¹	80, 000	-----	-----

¹ Owned by Mt. Isa Mines, Ltd.

The Anaconda Company.—25 Broadway, New York.—Incorporated June 18, 1895, in Montana, as Anaconda Copper Mining Co.; name was changed to The Anaconda Company June 18, 1955. The company and subsidiaries are engaged in mining, milling, and smelting nonferrous metal ores; refining and selling the metals obtained from these ores; fabricating semi-finished and finished copper and brass products; producing and fabricating aluminum; mining and processing uranium and manganese ores; and recovering, treating, and selling byproduct metals. The principal metals recovered from ores treated are copper, lead, and zinc; however, silver, gold, arsenic, cadmium, chromium, vanadium, selenium, and tellurium, also are recovered.

The company is both an operating and holding organization, having control of substantial stockholdings in the following subsidiaries:

Companies 100 percent owned:

Anaconda Aluminum Co.
Anaconda-American Brass Co.
Anaconda-American Brass, Ltd., Canada.
Anaconda Building Materials Co.
Anaconda Iron Ore (Ontario) Ltd.
Anaconda Sales Co.
Butte Anaconda & Pacific Railway Co.
International Smelting and Refining Co.
Montana Hardware Co.

Companies less than 100 percent owned:

	Percent owned
Andes Copper Mining Co.	99.446
Butte Water Co.	99.995
Chile Copper Co.	99.756
Chile Exploration Co.	99.756
Chile Steamship Co.	99.756
Greene Cananea Copper Co.	99.505
Inspiration Consolidated Copper Co.	28.17
Santiago Mining Co.	96.673

Capitalization:

\$600,000,000 in 12,000,000 shares of \$50 each; 10,715,127 shares outstanding, December 31, 1960.

Assets and liabilities:

December 31, 1960, total current assets, \$276,211,000; total current liabilities, \$58,145,353.
Employees, 1960: 37,000.

Mines:

Principal mining operations in the United States are at Butte, Mont.; Yerington, Nev.; and near Grants, N.M. At Butte large low-grade copper deposits were developed in the noted Greater Butte Project:

Kelley Mine.—This was started as a block-caving operation in 1952; an average of 11,500 tons of ore per day was mined in 1960.

Berkeley Mine.—The open-pit, 32,610 tons of ore was produced daily in 1960, a 14-percent increase over 1959. Projects in preparation for working the high-grade vein deposits at deeper levels were initiated in 1960 as plans for deepening the Kelley No. 1, Steward, and Mountain Con shafts got under way.

Yerington Mine.—At Weed Heights, Lyon County, Nev., production was started in November 1953. The oxide ore is leached and the copper is recovered by cementation on scrap iron; the sulfide ore is concentrated in a newly constructed flotation mill. Precipitation from the cementation process and the sulfide concentrate are shipped to the company smelter at Anaconda, Mont.

The company also produces uranium bearing ores from the open-pit Jackpile mine in New Mexico and a 3,000-ton-per-day uranium processing plant at Bluewater, New Mexico.

Company subsidiaries own and operate the following large mines in Chile:

Chuquicamata Mine.—The largest copper mine in the world, Chuquicamata, is operated by Chile Exploration Co., a wholly owned subsidiary of Chile Copper Co., which in turn is 99.756-percent owned by The Anaconda Company. Plant facilities consist of a leaching plant, concentrator and molybdenum recovery unit, smelter, electrolytic refinery, and electrowinning refinery.

El Salvador Mine.—Operated by Andes Copper Mining Co., the mine and plants have a productive capacity of 115,000 tons of copper per year. Operations began in April 1959. Concentrate is transported by pipeline and rail for treatment in the company Potrerillos smelter.

La Africana Mine.—Operated by Santiago Mining Co., the mine is about 15 miles west of Santiago, Chile.

A 400-ton-per-day concentrator was erected, and production was started in September 1957.

In Mexico, Compania Minera de Cananea, S.A. de C.V., formerly the Cananea Consolidated Copper Company, a 99.97 percent owned subsidiary of Greene Cananea Copper Company, has an open-pit and underground mine, a concentrator, and a smelter near Cananea, Sonora. A small portion of the copper is produced from leaching-in-place of waste dumps and mined-out portions of the underground mine. The concentrator treats 16,000 tons of ore a day and furnishes the smelter with 650 to 700 tons of concentrate daily. Blister copper cakes, containing significant recoverable quantities of gold and silver, are the end product of Cananea operations. Cananea blister is refined and fabricated in plants near Mexico City in which Anaconda has a substantial interest. Cananea is the source of all the copper refined and fabricated in Mexico, and the major portion of this copper is consumed in Mexico.

Smelters and refineries:

In the United States The Anaconda Company has a copper smelter at Anaconda, Mont., having an annual capacity of 1 million tons of charge, and a lead smelter at Tooele, Utah, having a capacity of 300,000 tons of lead. Copper refineries are at Great Falls, Mont., 150,000 tons capacity; and Perth Amboy, N.J.; International Smelting and Refining Co., 240,000 tons capacity. The company also has an electrolytic zinc plant at Great Falls, Mont., having an annual capacity of 162,000 tons of slab zinc. Production by The Anaconda Company, copper, short tons:

Appalachian Sulphides, Inc.—Jefferson, N.C.—Appalachian Sulphides, Inc., a wholly owned subsidiary of Nipissing Mines Company, Ltd., incorporated in Ontario, Canada, in 1952, owns and operates the Ore Knob mine at Jefferson, N.C., which ranked 22d as a copper producer in the United States in 1960. Concentrates produced in its 750-ton-per-day mill are shipped to U.S. Metals Refining Co. (American Metal Climax, Inc.) at Carteret, N.J., for smelting and refining; the refined metal is marketed by Phillips Bros. Division of Minerals & Chemicals, Phillips Corp.

Production in 1960 was 5,438 tons of copper, 26 percent greater than in 1959; 23,300 ounces of silver; and 1,694 ounces of gold. From the beginning of operations, in March 1957 until December 31, 1960, the mine produced 17,482 tons of copper, 93,355 ounces of silver, and 6,143 ounces of gold. (This mine was acquired by Copper Range Co. in 1960 and was closed in 1962.)

Bagdad Copper Corp.—Bagdad, Ariz.—Incorporated February 28, 1927, in Delaware. The corporation operates an open-pit mine and flotation mill in the Eureka mining district, Yavapai County, Ariz. The mill has a capacity of 3,500 tons daily and concentrates are shipped to the American Smelting and Refining Co. smelter at Hayden, Ariz.

Two miles west of the present mill, construction of a \$2 million leaching plant and auxiliary sulfuric acid plant was started in July 1960, to recover copper from low-grade copper ore; estimated production from this unit will amount to about 20 tons of copper per day.

Capitalization:

800,000 shares authorized; 558,458 shares outstanding; 241,542 shares in treasury; par \$5, changed from \$1 par in 1934.

Assets and liabilities:

Total current assets, December 31, 1960, were \$1,917,367; total current liabilities, \$794,873.

Employees: December 31, 1960, 351.

Production:

Copper—1960, 11,931 tons; 1959, 11,975 tons. The Bagdad mine ranked 20th as a copper producer in the United States in 1960.

Production by The Anaconda Company, copper, short tons:

Domestic:		1959	1960
Montana:			
Vein mines.....		18,403	26,336
Kelley mine.....		18,130	19,458
Berkeley pit.....		32,634	44,281
Other.....		1,029	922
Total.....		70,196	90,997
Nevada: Yerington mine.....		20,332	42,697
Total.....		90,528	133,694
Foreign:			
Chile:			
Chuquicamata.....		306,497	254,778
El Salvador.....		60,314	86,859
La Africana.....		3,558	5,907
Total.....		370,369	347,544
Mexico: Cananea.....		32,182	30,976
All production, short tons:			
Copper:		1959	1960
Company mines.....	469,276	451,248	415,120
Purchased and toll material.....	99,985	99,788	84,148
Total.....	569,261	551,036	499,268
Zinc:		1959	1960
Company mines.....	46,504	37,297	16,534
Purchased and toll material.....	175,494	175,188	142,599
Total.....	221,998	212,485	159,133
Aluminum.....	61,512	52,056	49,846
Lead.....	44,788	41,310	22,336
Silver, ounces.....	12,006	11,042	7,374
Gold, ounces.....	79	78	59
Manganese oxide nodules, about 60 percent Mn.....	72,834	65,223	61,409
Ferromanganese, about 80 percent Mn.....	39,671	22,407	25,825
Arsenic trioxide.....	2,121	1,960	2,699
Cadmium.....	978	857	623

Banner Mining Co.—2042 Conner Stravenue, Tucson, Ariz.—Incorporated under Nevada laws September 27, 1935. The company owns two mines and a 400-ton-per-day mill at Lordsburg, N. Mex.; three mines and a 1,000-ton-per-day mill near Tucson, Ariz.; and mining claims near Lordsburg, N. Mex., and in Pima County, Ariz.

Mines:

New Mexico.—Bonney and Misers Chest.

Arizona.—Mineral Hill, Daisy, and Palo Verde.

Production:

	1959	1960
Copper..... tons..	3,109	3,200
Gold..... ounces..	354	902
Silver..... do.....	74,576	61,477

Employees: December 31, 1960, 245.

Capitalization:

December 31, 1960, 600,000 shares authorized; 580,030 shares outstanding; par \$1.

Assets and liabilities:

December 31, 1960, total current assets, \$579,480; total current liabilities, \$324,309.

Bethlehem Cornwall Corp.—Bethlehem, Pa.—The corporation is a wholly owned subsidiary of Bethlehem Steel Co., operating the Cornwall mine, Cornwall, Lebanon County, Pa. The mine is mainly an iron producer, but considerable copper, gold, and silver are recovered as byproducts, and it ranked 25th

among copper producers in the United States in 1960. Ore is mined by block caving. Daily capacity of the magnetic separation plant is 6,000 tons; the flotation plant, 2,200 tons; and the sintering plant, 2,400 tons. The copper concentrate is shipped to Phelps Dodge Refining Corp. at Laurel Hill, N.Y. Production of copper increased in 1960 to 3,085 short tons from 1,935 tons in 1959.

Calumet & Hecla, Inc.—122 South Michigan Ave., Chicago 3, Ill.—Incorporated as Calumet & Hecla Consolidated Copper Co., September 10, 1923, consolidating Calumet & Hecla Mining Co., Ahmeek Mining Co., Allouez Mining Co., Centennial Copper Mining Co., and Osceola Consolidated Mining Co. Present name was adopted October 31, 1952.

Calumet & Hecla, Inc., is primarily an operating company that is completely integrated with respect to copper, having mining, smelting, refining, and fabricating operations. It operates deep-shaft copper mines and related processing facilities on the Keweenaw Peninsula of upper Michigan. It also has a uranium mine in the Ambrosia Lake district, near Grants, N.M. However, the company is primarily a metal fabricator—having principal plants in Detroit, Mich.; London, Ontario, Canada, and Decatur, Ala.

The Wolverine Tube Division (formerly Wolverine Tube Corp.) is one of the largest single units producing seamless nonferrous tubing. A wholly owned subsidiary, Canada Vulcanizer & Equipment Co., Ltd., London, Ontario, Canada, manufactures fin tubing, Unifin, used in heat transfer equipment. Calumet &

Hecla of Canada, Ltd., London, Ontario, Canada, 100 percent owned, produces nonferrous tubing and tube products.

Other important divisions and subsidiaries are:

Goodman Lumber Division—an integrated lumbering operation involved in the selective cutting and processing of mature timber for the building trades, furniture plants, and other wood-using industries.

Flexonics Corp. of Canada, Ltd., Brampton, Ontario—producing aeronautical and missile products, industrial and automotive hose, expansion joints, and bellows.

Flexonics Division at Bartlett, Ill.—producing the same materials as the Canadian plant.

Alabama Metallurgical Corp. (Alamet), 70-percent owned—with plants at Ryan and Selma, Ala., for mining dolomite and for producing primary magnesium and calcium.

Lake Chemical Co., Mich., 50-percent owned—producing and marketing chemical products. (Other 50 percent owned by Harshaw Chemical Co.)

Capitalization:

100,000 shares of \$4.75 cumulative preferred stock, Series A, no par value and 5,000,000 common shares of \$5 each authorized; 41,220 shares of preferred and 2,159,571 shares of common stock outstanding, December 31, 1960.

Assets and liabilities:

December 31, 1960, total current assets, \$23,577,130; total current liabilities, \$5,844,132.

Employees: December 31, 1960, 3,928.

Production:

Calumet & Hecla, Inc., ranked 17th among the major copper producers in the United States in 1960. Production of primary copper was 16,163 short tons, a decrease from 17,407 tons in 1959. Total production of refinery shapes from primary, secondary, and toll copper was 26,648 tons.

Cerro Corp.—300 Park Ave., New York 22.—Incorporated in New York, October 27, 1915, as Cerro de Pasco Copper Corp.; name changed to Cerro de Pasco Corp. May 31, 1951, and to present title December 30, 1960. The company is an operating and holding company with interests in the United States, Peru, and Chile.

By a reorganization of the company, January 1, 1957, the mining properties, concentrators, smelters, and refineries in Peru were transferred to a wholly owned subsidiary, Cerro de Pasco Corp., incorporated in Delaware. Also, all petroleum exploration concessions in Peru formerly owned by the parent company were acquired by another wholly owned subsidiary, Cerro de Pasco Petroleum Corp. Other wholly owned subsidiaries are: Cerro Sales Corp., Circle Wire and Cable Corp., and Fairmont Aluminum Co.

The Lewin-Mathes Company was acquired in 1957 and was operated as a division of Cerro Corp. for secondary smelting and refining of nonferrous metals and manufacture of brass tube and pipe. In 1959, all assets of Consolidated Coppermines Corp. were acquired and its subsidiaries Rockbestos Wire & Cable Co. and Titan Metal Manufacturing Co. operated as divisions of the parent company. The Viking Copper Tube

Company, a specialized manufacturer of high-quality seamless copper tube in Cleveland, Ohio, was acquired in June 1961. Early in 1962 Lewin-Mathes, Titan, and Viking were unified into a single division of the parent corporation and called the Cerro Copper & Brass Company Division. Cerro Corp. owns 96.7 percent of the capital stock of Rio Blanco Copper Corp., Ltd., which controls ownership of the Rio Blanco orebody in Chile and holds a 22¼ percent interest in the capital stock of Southern Peru Copper Corp.

Capitalization:

\$46,250,000; 4,250,000 shares of common stock \$5 par value and 250,000 shares preferred stock \$100 par value. Issued December 31, 1960, 2,646,132 shares common stock.

Mining, smelting, and refining facilities:

In the United States:

Lewin-Mathes Company Division; secondary smelter and electrolytic refinery, Monsanto, Ill.

In Chile:

Compania Minera Andina, S.A., Rio Blanco copper mining project, near Santiago, Chile; in initial development.

In Peru:

Cerro de Pasco Corp., incorporated in Delaware; see Peru.

Southern Peru Copper Corp., 22¼ percent interest:

Toquepala mine, mill, and smelter in southern Peru.

Compania de Minas Buenaventura, S.A., 32.5 percent interest; metal mining.

Explosives, S.A., 31.4 percent interest; explosives manufacture.

Refractarios Peruanos, S.A., 42 percent interest; manufacture of refractory brick.

Compania Minera Raura, S.A., 60 percent interest; metal mine in development stage.

Copper and brass mills in the United States:

Cerro Copper & Brass Company Division, copper and brass tube mill, Monsanto, Ill.; brass rod and wire mills, Bellefonte, Pa.; fabricated brass products mill, Bellefonte, Pa.; brass rod and brass forging mill, Newark, Calif.

Wire and cable mills:

Circle Wire & Cable Corp.:

Wire and cable mill, Maspeth, Long Island, N.Y.

Copper rod and steel-strip mills, Hicksville, Long Island, N.Y.

Electrical metallic-tube plant, Hicksville, Long Island, N.Y.

Rockbestos Wire & Cable Co. Division:

Wire and cable mill, New Haven, Conn.

Industrias de Cobre, S.A., 46 percent interest:

Copper wire and cable mill, Lima, Peru.

Aluminum rolling mills:

Fairmont Aluminum Co.:

Aluminum rolling mill, Fairmont, W. Va.

United Pacific Aluminum Co. Division:

Aluminum rolling mill, Los Angeles, Calif.

	1959			1960		
	From corpo- ration ores	From pur- chased ores	Total	From corpo- ration ores	From pur- chased ores	Total
Metal production:						
Copper..... tons.....	26, 701	10, 182	36, 883	26, 918	9, 878	36, 796
Lead..... do.....	26, 362	35, 899	62, 261	33, 186	46, 757	79, 943
Zinc..... do.....	29, 595	---	29, 595	35, 156	---	35, 156
Silver..... 1,000 ounces.....	5, 023	7, 112	12, 135	6, 044	8, 920	14, 964
Gold..... do.....	23	13	36	22	20	42

Principal nonferrous metal products:

Electrolytic copper. Electrolytic-lead-corroding, chemical and antimonial grades: Electrolytic zinc, special high-grade and die-casting grade: Refined silver, gold, refined bismuth, bismuth alloys, cadmium, tellurium, selenium, crude antimony, and zinc concentrates.

Brass mill and wire mill products: Copper and copper alloy sheet, strip, tube, pipe, rod, bar, circles, and other semifabricated shapes. Also aluminum sheet, strip, circles, and blanks.

Cerro de Pasco Corp. produces about 16 percent of the bismuth consumed annually in the world; about 60 percent is used in producing fusible alloys, and the remainder is used for pharmaceutical and industrial purposes.

Copper Range Company.—24 Federal St., Boston 10, Mass.—Incorporated in Michigan, January 20, 1899. Since incorporation the company has acquired:

Copper Range Consolidated Co., 1915.
Baltic Mining Co., 1917.
Trimountain Mining Co., 1923.
Atlantic Mining Co., 1925.
Whealkate Mining Co., 1928; mineral rights.
South Range Mining Co., 1928; mineral rights.
White Pine Copper Co., 1929.
Victoria Copper Co., 1929.
National Mining Co., 1929.
Copper Range Motor Bus Co., 1929.
Champion Copper Co., 1931.
Naumkeag Copper Co., 1931.
St. Mary's Mineral Land Co., 1931.
St. Mary's Canal Mineral Land Co., 1931.
C. G. Hussey & Co., 1936.
Globe Properties, 1937.
Copper Range R.R. Co.; company owns 78 percent of issued stock.
Alloyd Corp., Cambridge, Mass.; minority interest, 1959.

The company acquired control of C. G. Hussey and Company of Pittsburgh, manufacturers of sheet copper in 1931 and acquired the remainder of the stock in 1936.

Capitalization:

Authorized 3,000,000 shares of \$5 each; outstanding December 31, 1960, 1,877,473 shares.

Assets and liabilities:

December 31, 1960, total current assets, \$30,187,875; total current liabilities, \$4,036,732.

Employees: December 31, 1960, 2,364.

Copper production, 1960:

Champion mine.....	short tons..	2, 482
White Pine mine.....	do.....	37, 463
Total.....		39, 945

Mines and plants:

White Pine Mine.—Located at White Pine, Mich., about 50 miles southwest of the Champion mine. Operated by White Pine Copper Co., a wholly owned subsidiary, which was organized in 1950 to develop the White Pine ore body. November 15, 1951, the Reconstruction Finance Corp. approved 20-year, 5-percent mortgage loans totaling \$64,395,599 to finance development and for constructing mining, milling, smelting, and housing facilities. On December 31, 1960, the loan had been reduced to \$39,080,731. The mill has a capacity of 10,500 tons daily, and the smelter is capable of producing 50,000 tons of refined copper annually. Production commenced January 31, 1955. On February 15, 1952, the Government contracted with White Pine to purchase 275,000 tons of refined copper at 25½ cents per pound plus escalations due to increases in government cost indexes (labor, etc.). In December 1957, White Pine Copper Co. exercised its option under

this contract to deliver its production to the Government. The price of copper had dropped to 27 cents per pound, and the escalated contract price was 28.5 cents per pound.

Champion Mine.—Located at Painsdale, Mich.; ore is shipped to the company Freda mill. Production amounted to 2,482 tons in 1960.

Freda Mill.—Freda, Mich., 2,100 ton gravity and flotation plant treats ore from the Champion mine and Redridge tailings. Concentrates are shipped to the White Pine smelter.

Douglas Mine.—Keweenaw County, Mich. Leased to Calumet & Hecla, Inc.

Copper and Brass Rolling Mills.—Operated by C. G. Hussey & Company, a wholly owned subsidiary, at Pittsburgh, Pa.

Cyprus Mines Corp.—523 West 6th St., Los Angeles 14, Calif.—Incorporated March 10, 1916, in New York. Operates the Old Dick mine near Bagdad, Ariz., and has a 50-percent interest in Pima Mining Co., which has the Pima open-pit mine near Tucson, Ariz. Has leasehold concessions on copper and pyrite mines on the Island of Cyprus. These mines are the Mavrovouni, Skouriotissa, and Apliki. The corporation also has interests in 43 producing oil wells and gas wells in Kansas, Texas, and Louisiana; owns sawmills and plywood plants at Medford, Oreg., and timberlands in Oregon, California, Alabama, and British Columbia. It is affiliated with Marcona Mining Co., 43.75 percent, and Cia. San Juan, S.A., 44.65 percent; Albatross Sulfuric Acid & Chemical Works, Rotterdam, 45 percent; Hawaiian Cement Corp., 42 percent; and Titanium Dioxide Works, Ltd., Rotterdam, 22.50 percent.

Capitalization:

Authorized 7,500,000 shares of \$4 each, outstanding December 31, 1960, 4,883,000 shares.

Assets and liabilities:

December 31, 1960, total current assets, \$58,584,644; total current liabilities, \$8,452,852.

Employees: December 31, 1960, 3,311.

Production, short tons:**United States:**

Pima mine:	1959	1960
Ore.....	1, 200, 606	1, 327, 473
Concentrate....	56, 590	50, 044
Old Dick mine:		
Ore.....	76, 111	80, 940
Copper concen- trate.....	8, 078	11, 028
Zinc concen- trate.....	19, 350	12, 661

Cyprus, island mines:

Ore.....	888, 094
Copper concentrate.....	104, 807
Flotation pyrite.....	509, 976
Cupreous pyrite.....	195, 237
Copper precipitate.....	224, 112

Reserves, December 31, 1960:

United States:	Short tons	Copper, percent	Zinc, percent
Pima mine.....	6, 600, 000	1. 64	-----
Old Dick mine....	353, 000	3. 30	11. 3
Cyprus:			
Mavrovouni.....	2, 058, 000	3. 6	47. 5
Skouriotissa.....	2, 800, 000	2. 0	40. 0
Apliki.....	1, 848, 000	1. 8	36. 0

Duval Sulphur & Potash Co.—1906 First City National Bldg., Houston 2, Tex.—Incorporated as Duval Texas Sulphur Co. under Texas laws August 18, 1926. Present name adopted February 13, 1950. Company is controlled by United Gas Corp., which owns 75 percent of the outstanding stock. It is engaged

in mining, processing, and marketing sulphur, potash, and copper concentrates.

Copper ore is mined and concentrated at the company Esperanza open-pit mine about 28 miles south of Tucson, Ariz. Stripping of waste overlying the ore body commenced in 1957 and continued into 1959. Construction of the 12,000-ton-per-day mill was completed in February, and production began in March 1959. The concentrate is treated for recovery of molybdenite, and the copper concentrate is shipped to the American Smelting and Refining Co. smelter at Hayden, Ariz. The production of copper-in-concentrate was 17,036 tons in 1959 and 25,368 tons in 1960.

Capitalization:

Authorized, 2,000,000 shares; outstanding, 1,300,000 shares on Dec. 31, 1960.

Assets and liabilities:

December 31, 1960, total current assets, \$15,064,746; total current liabilities, \$4,676,795.

Employees: December 31, 1960, 742.

Inspiration Consolidated Copper Co.—25 Broadway, New York 4, N.Y.—Incorporated December 18, 1911, in Maine, as a consolidation of Inspiration Copper Co. and Live Oak Development Co. Subsequently other properties were acquired from Warrior Copper, New Keystone Copper, Porphyry Consolidated Copper, and Southwestern Development companies. In 1955 the Christmas mine was purchased from Christmas Copper Corp., and the Miami, Ariz., smelter of International Smelting and Refining Co. was purchased on April 1, 1960.

Capitalization:

Authorized 1,500,000 shares of \$20 each; outstanding on December 31, 1960, 1,181,967 shares.

Assets and liabilities:

December 31, 1960, total current assets, \$21,162,747; total current liabilities, \$3,112,785.

Employees: December 31, 1960, 1,503.

Mines and Plants:

The Inspiration mine, the sixth largest in Arizona, consists of two open-pit operations, the Thornton and the Live Oak pits. Mixed oxide-sulfide ore is treated by the dual process adopted in 1957. In this process the ore is leached with dilute sulfuric acid solutions that dissolve the soluble oxide copper content and about 35 percent of the sulfide content; the leached residue from this process is treated at the concentrator by flotation for recovery of the undissolved sulfide minerals, and the concentrate is smelted to blister copper. The electrolytic plant is divided into two sections. One section is devoted to electrowinning copper directly from leaching solutions; the other is employed for electrorefining anode copper resulting from the smelting of copper concentrate and precipitate. Cathodes are shipped to the International Smelting and Refining Co. refinery at Perth Amboy, N.J., for melting and casting into marketable shapes.

Copper is also recovered from leaching-in-place certain caved and mined-out underground areas and surface waste dumps. Copper is precipitated from this leach solution with scrap iron by the cementation process, and the precipitate is sent to the smelter.

Copper production in 1960 from ores—0.857 percent copper, 0.448 percent oxide, 0.409 percent sulfide—was almost 38,000 tons and from leaching in place operations was 2,500 tons. Production of molybdenum amounted to 433,681 pounds contained in sulfide concentrates.

Development work at the Christmas mine and construction of a 4,000-ton-per-day concentrator were completed in July 1962 and operations began in August.

Concentrates are trucked to the Inspiration smelter at Miami, Ariz.

Kennecott Copper Corp.—161 East 42nd St., New York 5.—Incorporated in the State of New York, April 29, 1915. The company is an operating and holding concern and with its subsidiaries is engaged in these two kinds of business: (1) The chief activity is operation of its copper mines, concentrators, smelters, and refineries and sale of refined copper and other metals recovered as byproducts in the copper operations—including molybdenum, gold, silver, selenium, tellurium, rhenium, platinum, and palladium; and (2) the fabrication of copper and brass into mill products or finished items. Titanium and columbium are produced by Quebec Iron & Titanium Corp. and Tin & Associated Minerals, Ltd., subsidiaries. A list of the subsidiaries with the percent of voting control and business follows:

Companies 100 percent owned:

Bear Creek Mining Co.
Braden Copper Co., Chile.
Chase Brass & Copper Co., Inc.
Kennco Exploration, Ltd., Canada.
Kennecott Sales Corp.
Kennecott Refining Corp.
Metal Sales Co., Ltd., England.
Mines Products Corp.
Nevada Northern Railway Co.
Ozark Lead Co.
Ridge Mining Corp.
The Okonite Co.

Companies less than 100 percent owned:

	Percent
Allied-Kennecott Titanium Corp.	50.0
Garfield Chemical & Manufacturing Corp.	50.0
Kenbestos Mining Co., Ltd., Greece	95.0
Quebec Columbian Ltd., Canada	45.9
Quebec Iron & Titanium Corp., Canada	66.67
The Superior Wire Cloth Co.	68.1
Tin Associated Minerals Ltd., Nigeria	76.0

Through investment, the company has interests in Kaiser Aluminum & Chemical Corp.; Molybdenum Corporation of America; Compania de Acero del Pacifico; Western Phosphates, Inc.; and other companies.

Capitalization:

Authorized 12,000,000 shares; outstanding November 30, 1960, 11,053,051 shares; no par.

Assets and liabilities:

December 30, 1960, total current assets, \$301,036,716; total current liabilities, \$53,274,177.

Employees: December 31, 1960, 27,205.

Production:

	1959	1960
Copper, short tons:		
Domestic	235,228	384,088
Chilean	182,017	187,221
Total	417,245	571,309
Molybdenite, thousand pounds	20,967	27,426
Gold, ounces	240,179	396,839
Silver, do.	2,167,469	3,700,784

Mines and plants:

Utah Copper Division.—In Bingham, Utah, the Utah Copper Division mine is the second largest copper producer in the world, ranking next to the Chile Exploration Co. Chuquicamata mine. Open-pit mining covers an area of 1,042 acres, and an average of 90,000 tons of ore is produced daily; in 1960 the ore averaged 0.81 percent copper. The ore is concentrated in company mills at Magna and Arthur, Utah. Both of these mills have molybdenite recovery units. The copper concentrate

is shipped to the Utah smelter—annual capacity 1,225,000 tons of charge—and the blister copper is refined at the company electrolytic refinery, also at Garfield—capacity 204,000 tons of refined copper.

Chino Mines Division.—Comprised of the Chino mine at Santa Rita, N. Mex., and a concentrator and smelter at Hurley, N. Mex., 9 miles away. The Chino mine, an open-pit operation, was the sixth largest copper producer in the United States in 1960 with its output of 62,725 tons. Approximately 30 percent of this production was recovered from an enlarged and improved precipitation system handling dump-leach solutions. Most of the output of this division is marketed as fire-refined copper.

Ray Mines Division.—The Ray open-pit mine, Ray, Ariz., ranked eighth among United States copper producers in 1960. The ore is concentrated and smelted in company facilities at Hayden, Ariz. Sponge iron is produced from pyrite and is used as the precipitant in the complex leach-precipitation-flotation process employed at the mill for recovery of both oxide and sulfide values in the ore. Ore mined in 1960 averaged 0.9 percent copper; 58,799 tons of copper was produced. A substantial amount of copper was recovered from leaching abandoned underground block-caving areas. The blister copper is shipped to the refineries of Kennecott Refining Corp. and American Smelting and Refining Co. in Baltimore, Md.

Nevada Mines Division.—Mining has been concentrated in the Liberty Pit, Ruth, Nev., for more efficient mining and utilization of manpower. Previously ore was mined simultaneously from three pits. In 1960, the Liberty Pit ranked ninth among copper producers in the United States; 47,439 tons of copper was produced from ore averaging 0.79 percent copper. The ore is concentrated, then smelted in company plants at McGill, Nev. Blister copper produced is refined at the refineries of Kennecott Refining Corp. and American Smelting and Refining Co. in Baltimore, Md.

Kennecott Refining Corp.—A wholly owned subsidiary, operating the new electrolytic refinery completed in 1960—annual capacity, 198,000 tons—in Anne Arundel

County, Md., where blister copper from the western divisions and Braden Copper Co. in Chile is refined.

El Teniente Mine.—In Sewell, Chile, see Braden Copper Co. under foreign producers.

Allard Lake Mines.—In eastern Quebec, Canada; iron-titanium properties are owned by the Quebec Iron & Titanium Corp. Ore treatment facilities are at Sorel, Quebec. One hundred million tons of ore, averaging 82 percent combined iron and titanium oxides, has been outlined and is being developed as an open-pit mine. In 1960, 863,726 tons of ore was treated for a production of 221,945 tons of iron and 345,213 tons of titanium slag.

Magma Copper Co.—300 Park Avenue, New York 22.—Incorporated in Maine, May 7, 1910. Magma Copper Co. is an operating and holding company engaged in mining and treating copper ore. Newmont Mining Corp. owns 82.5 percent of the company stock. The following subsidiaries are 100 percent owned:

Magma Arizona Railroad Co.
San Manuel Copper Corp.
San Manuel Arizona Railroad Co.
San Manuel Townsite Co.

Capitalization:

Authorized, 3,000,000 shares; outstanding December 31, 1960, 1,264,940 shares, par \$10. The San Manuel Copper Corp. has an authorized capital of 1,500,000 shares of \$1 par value; all outstanding shares are owned by Magma Copper Co.

Assets and liabilities:

December 30, 1960, total current assets, \$32,426,182; total current liabilities, \$8,411,694.

Employees: December 31, 1960, 1,100.

Mines and Plants:

Magma Copper Co.—The Magma mine, mill, and smelter are at Superior, Pinal County, Ariz. The property has been developed by eight shafts and has been in commercial production since 1915. In 1960, the Magma mine ranked 15th as a copper producer in

Production, San Manuel Copper Corp.:

	1958	1959	1960
Copper.....short tons.....	74,701	46,170	81,724
Molybdenite.....pounds.....	1,872,450	1,435,613	2,807,671
Gold.....ounces.....	16,868	10,232	18,010
Silver.....do.....	253,858	158,594	290,617

the United States. The concentrator has capacity for treating 1,500 tons of ore per day, and the smelter has an annual capacity of 150,000 tons of charge. The blister copper produced is refined by Phelps Dodge Refining Corp.

Production, Magma Copper Co.:

	1958	1959	1960
Copper...short tons...	20,658	13,011	18,917
Gold.....ounces.....	12,623	9,302	14,374
Silver.....do.....	552,009	368,004	624,141

In 1960 the mine produced 386,636 tons of ore—assaying 5.10 percent copper, 0.04 ounce gold, and 1.73 ounces silver.

San Manuel Copper Corp.—The San Manuel mine is one mile south of Tiger, Pinal County, Ariz., and 45 miles northeast of Tucson. The concentrator and smelter are approximately seven miles from the mine at the townsite of San Manuel, Ariz. In 1960, 12.3 million tons of 0.71 percent copper ore was mined for an average of 34,250 tons per operating day. In copper production the mine ranked fourth among the United States producers.

Newmont Mining Corp.—300 Park Avenue, New York 22.—Incorporated as Newmont Corp. in Delaware,

May 2, 1921, as successor to Newmont Co. (Maine) Present title adopted June 2, 1925. Newmont is a holding company engaged in exploration, development, and financing of mining and petroleum properties and in investment of its capital in securities of existing mining and oil companies.

Exploration and development of nonferrous metal deposits has been conducted in North and South America, Africa, Europe, and the Philippine Islands. The company interest in mining and petroleum industries is indicated by the following partial list of its holdings:

Company:	Percent owned
Canadian Export Gas & Oil Ltd.....	16.0
Cassiar Asbestos Corp., Ltd.....	16.4
Continental Oil Co.....	4.5
Creole Petroleum Corp.....	<1.0
Cyprus Mines Corp.....	12.2
Dawn Mining Co.....	51.0
El Paso Natural Gas Co.....	<1.0
Granduc Mines, Ltd.....	37.6
Idarado Mining Co.....	74.2
Lucky Friday Silver-Lead Mines Co.....	11.0
Magma Copper Co.....	82.5
Newmont Mining Corp. of Canada, Ltd....	100.0

Company—Continued	Percent owned
Newmont Oil Co.-----	100. 0
O'okiep Copper Co., Ltd.-----	56. 3
Palabora Mining Co., Ltd.-----	26. 0
Phelps Dodge Corp.-----	2. 9
St. Joseph Lead Co.-----	3. 9
Sherritt Gordon Mines, Ltd.-----	37. 4
Societe Algerienne du Zine.-----	31. 8
Societe Nord-Africaine du Plomb.-----	31. 8
Southern Peru Copper Corp.-----	10. 3
Tennessee Gas Transmission Co.-----	<1. 0
Transcontinental Gas Pipe Line Corp.-----	1. 6
Tsumeb Corp. Ltd.-----	28. 5

Capitalization:

Authorized 6,000,000 shares; outstanding December 31, 1960, 2,824,518 shares; par \$10.

Assets and liabilities:

December 31, 1960, total current assets, \$11,675,088; total current liabilities, \$1,754,247.

Phelps Dodge Corp.—300 Park Avenue, New York 22.—Incorporated in New York, August 10, 1885, as Copper Queen Consolidated Mining Co.; present name adopted in 1917. Through the years the company has acquired Detroit Mining Co., Burro Mountain Copper Co., Stag Canon Fuel Co., Montezuma Copper Co., Nicholas Copper Co., National Electric Products Corp., Calumet & Arizona Mining Co., United Verde Copper Co., and the Tucson, Cornelia and Gila Bend R.R. Co.

Phelps Dodge Corp., with its subsidiaries, is engaged in copper mining, milling, smelting, refining, fabricating, and selling. The company also does custom smelting and refining and operates railroads, electric utility companies, and general merchandise stores—all incidental to its various operations.

Copper is the principal metal produced. Molybdenite concentrates, gold, silver, platinum, palladium, selenium, and tellurium also are recovered from the ores. The company makes and markets copper sulfate and nickel sulfate. Over half of the copper produced is marketed in semifabricated and fabricated forms, such as rod, wire, tube, and extruded shapes.

The company is both a holding and operating concern, owning 100 percent of the stock of the following subsidiaries on December 31, 1960:

Ajo Improvement Co.
Anson Mines, Ltd., Canada.
Ashfork Mines, Ltd., Canada.
Cochise Publishing Co.
Colfax Mines, Ltd., Canada.
Mesa Mines Ltd., Canada.
Moctezuma Copper Co.; inactive.
Morenci Water & Electric Co.
New Cornelia Cooperative Mercantile Co.
Phelps Dodge Corp. of Canada, Ltd.
Phelps Dodge Copper Products Corp.
Phelps Dodge Copper Products International Corp.
Phelps Dodge Copper Products, Puerto Rico.
Phelps Dodge Exploration Corp.
Phelps Dodge Mercantile Co.
Phelps Dodge Refining Corp.
Showlow Mines Corp.
Stargo Mines, Ltd., Canada.
Tempe Mines Corp.
T.C. & G.B. Railroad Co.
Tyrone Mines, Ltd., Canada.
Warren Co.
Yuma Mines, Ltd., Canada.

Other interests are: Phelps Dodge Copper Products of the Philippines—51-percent owned; United States Underseas Cable Corp.—formed in March 1960 jointly with Northrup Corp. and Felton & Guillaume Carlswerk Aktiengesellschaft of Cologne, West Germany.

Capitalization:

Authorized, 12,000,000 shares; issued, 10,855,522 shares; in treasury, 713,002 shares; outstanding December 31, 1960, 10,142,520 shares; par \$12.50

Assets and liabilities:

December 31, 1960, total current assets, \$211,663,037; total current liabilities, \$40,132,396.

Employees: December 31, 1960, 13,735.

Production:

	1959	1960
Copper, short tons:		
Smelter production..	193, 557	234, 081
Refined production..	315, 001	410, 857
Silver.....ounces..	2, 289, 130	3, 281, 413
Gold.....do.....	88, 704	117, 414

Smelter production is derived from two sources, company ores and a very small amount of custom ores treated at its Arizona smelters. Refined production is from company smelter material and metals treated on toll for account of others and a very small amount of purchased custom material.

Mines and Plants:

Phelps Dodge Corp., Western General Offices, Douglas, Ariz.:

Morenci Branch, Morenci, Ariz.—This comprises open-pit mine, concentrator, and smelter. The Morenci open-pit mine is the second largest copper producer in the United States. It is the leading producer in Arizona, where it ranked second in molybdenum, third in silver, and sixth in gold in 1960. Copper production 1960, 105,640 tons.

New Cornelia Branch, Ajo, Ariz.—This open-pit mine, concentrator, and smelter operation ranked fifth as a copper producer in the United States and third in Arizona in 1960; copper production was 66,693 tons.

Copper Queen Branch, Bisbee, Ariz.—Included are underground mines, Lavender open-pit mine, concentrator, and precipitation plant. The branch ranked seventh as a copper producer in the United States in 1960 and fourth in Arizona, where it was also first in gold and second in silver output. Copper production: Copper Queen, underground, 25,575 tons; Lavender Pit, 33,248 tons.

Douglas Reduction Works, Douglas, Ariz.:

Smelts ore and concentrate from the Copper Queen mine, concentrate from the Lavender Pit mill, precipitate from leaching operations at the Lavender Pit, some scrap, and a small tonnage of custom material. Smelter capacity is 1,250,000 tons of charge; 800,410 tons of copper-bearing material was smelted in 1960.

Moctezuma Copper Co., Nacozari, Sonora, Mexico:

Leaching of mine workings was discontinued in December 1960, and operations were completely shut down.

Phelps Dodge Refining Corp.:

El Paso Refinery, El Paso, Tex.—The copper refinery has an annual capacity for 290,000 tons electrolytic and 25,000 tons fire refined. Also copper sulfate and nickel sulfate plants.

Laurel Hill Refinery, Laurel Hill, Long Island, N.Y.—A copper refinery that has an annual capacity of 175,000 tons electrolytic and a copper smelter, having annual charge capacity of 200,000 tons. Also copper sulfate and nickel sulfate plants.

Phelps Dodge Copper Products Corp.:

American Copper Products Division, Bayway, N.J.—Rod and wire mill.

Bayway Tube Division, Bayway, N.J.—Alloy rods and extruded shapes.

Mines and Plants—Continued

Phelps Dodge Copper Products Corp.—Continued
South Brunswick Tube Division, South Brunswick, N.J.—Tube mill.

Habirshaw Cable and Wire Division, Yonkers, N.Y.—Insulated wire and cable mills.

Inca Manufacturing Division, Fort Wayne, Ind.—Magnet wire mill.

Indiana Rod and Wire Division, Fort Wayne, Ind.—Rod and wire mill.

Los Angeles Tube Division, Los Angeles, Calif.—Tube mill.

Quincy Mining Co.—63 Wall St., New York 5.—Incorporated in Michigan June 1, 1932, as successor in reorganization to a company of the same name—originally incorporated in Michigan by special charter granted March 30, 1848, reincorporated March 6, 1878, and in 1908. The company is engaged in mining and smelting copper and in real estate and securities investments.

Capitalization:

Authorized, 250,000 shares; outstanding, 131,400 shares; par \$25.

Assets and liabilities:

December 31, 1960, total current assets, \$2,359,526; total current liabilities, \$124,093.

Employees: December 31, 1960, 110.

Mines and Plants:

The company operates a tailing-reclamation plant for recovering copper in tailing deposited before 1910 in Torch Lake from the company mill, a mill with two gravity concentrators and flotation units of 5,500 tons daily capacity, and a smelter of 150 tons daily capacity. Copper production in 1960 was 1,722 tons.

Tennessee Corp.—61 Broadway, New York 6.—Incorporated October 14, 1916, in New York as Tennessee Copper & Chemical Corp., acquiring Tennessee Copper Co., which was incorporated April 24, 1899, in New Jersey to mine copper. Present name was adopted December 2, 1930. Tennessee Copper Co., a subsidiary, was dissolved December 31, 1956, and subsequently was operated as a division. Operating assets of Miami Copper Co. were acquired June 10, 1960; it is now operated as a division.

The company is engaged in producing copper, zinc concentrate, iron sinter, fertilizer, and chemicals. Its principal products are: (1) Commercial fertilizers; (2) super- and triple super-phosphate, used in company fertilizers and sold to others; (3) iron sinter, sold to operators of blast furnaces mainly in the Birmingham, Ala., district; (4) blister copper; (5) zinc concentrate; and (6) sulfuric acid, used by its own fertilizer plants and sold to other industries.

Tennessee Corp. is both a holding and an operating company. As of December 31, 1959, it owned 100 percent of the voting control of the following subsidiaries:

Adolph Lewisohn Selling Corp.
 Capital Fertilizer Co.
 Cleveland Agricultural Chemical Co.; inactive.
 Copper Cities Transportation Co.
 Number Twenty Copper Mining Co.; inactive.
 Sand Mountain Fertilizer Co.; inactive.
 Southern Agricultural Chemical Corp.; inactive.
 Tencor Trading Corp.
 Tennessee Copper Co.; inactive.
 Tenn.—Tampa Co.; inactive.
 The New Haven Copper Co., Seymour, Conn.
 The North Carolina Exploration Co.; inactive.
 U.S. Phosphoric Products Corp.; inactive.

It also owned 90 percent of Chester Cable Corp., a wire manufacturer. Holdings in Adolph Lewisohn and Chester Cable were acquired June 10, 1960, from Miami Copper Co.

Capitalization:

Authorized 5,000,000 shares; outstanding December 31, 1960, 3,935,529 shares; par \$1.25.

Assets and liabilities:

December 31, 1960, total current assets, \$56,196,000; total current liabilities, \$13,498,000.

Mines and Plants, Operating Divisions:

Tennessee Copper Company Division, Copperhill, Tenn.—The principal mines are the Polk County, Burra-Burra, Boyd, Calloway, and Eureka. The company operates flotation, roasting, sintering, smelting, and sulfuric acid plants. It ranked 19th among United States copper producers in 1960. Products are: Blister and shot copper, 50-percent zinc concentrate, 68-percent iron sinter, sulfuric acid, copper sulfate, copper salts and fungicides, liquid sulfur dioxide, organic sulfonates, sodium hydrosulfite, zinc oxide, and ferric sulfate (Ferri-Floc).

Miami Copper Company Division, Miami, Ariz.—Ore is mined by open-pit methods and treated to recover a copper concentrate at the Copper Cities mine. Copper precipitate, cement copper, is recovered by leaching at the Miami and Castle Dome mines. Copper concentrate and precipitate are smelted by Inspiration Consolidated Copper Co. at Miami, Ariz., and Phelps Dodge Copper Corp. at Douglas, Ariz.; the blister copper produced is refined by International Smelting and Refining Co. at Perth Amboy, N.J., and Phelps Dodge Refining Corp. at El Paso, Tex. The selling agent is Adolph Lewisohn Selling Corp.

U. S. Phosphoric Products Division, East Tampa, Fla.—This division produces triple superphosphate, superphosphate, hydrofluosilicic acid, sodium fluosilicate, potassium fluosilicate, and phosphoric acid and uranium.

Subsidiary Companies:

Capital Fertilizer Company, Montgomery and Decatur, Ala.—The Montgomery plant produces superphosphate and complete fertilizers. The Decatur plant produces complete fertilizers from superphosphate furnished by the Montgomery plant.

The New Haven Copper Co., Seymour, Conn.—Fabricates plate, sheet, strip, and roll copper.

Tencor Trading Corp.—Operates facilities for warehousing triple superphosphate and DiMoN at Peoria, Ill., and St. Paul and Winona, Minn.

Chester Cable Corp., Chester, N.Y.—This is a wire and cable mill.

Primary Copper Mills and Primary Wire Mills

The primary copper mines—formerly referred to as primary brass mills—make up that part of the industry engaged in initial forming or alloying and forming refinery shapes and scrap into standard semifabricated forms of copper and copper alloys; such as, plate, sheet, strip tube, rod, and wire. Subsequent operations involve further rolling, drawing, and shaping so that the products will meet specification dimension and design.

The primary wire mills roll refined copper wirebars or extrude refined copper billets into rods that are drawn in stages to finished wire. Wire is also produced by redraw mills that obtain rod from the primary wire mills. There are other types of mills designed for singular operations such as insulation and stranding.

The company names, addresses and plant locations of the primary copper and wire mills are shown in tables 74 and 75.

Principal Associated Government and Industry Groups

A number of government agencies and national associations deal with minerals and

metals and publish information regarding them. These organizations are shown in table 76. More information about government organizations is obtainable in "The United States Government Organization Manual", Federal Register Division, National Archives and Records Service, Washington, D.C. 20402, and the latest edition of the Official Congressional Directory, United States Government Printing Office.

TABLE 74.—Primary copper mills

Company	General Office	Location of fabricating plants	Type of products
American Smelting and Refining Company. Ampeco Metal, Inc. Anaconda American Brass Co.	120 Broadway, New York, N.Y. 1745 S. 38th St., Milwaukee 46, Wis. 414 Meadow St., Waterbury, Conn.	Perth Amboy, N.J. Milwaukee, Wis. Los Angeles, Calif.; Ansonia Torrington, Waterbury, Conn.; Detroit, Mich.; Buffalo, N.Y.; and Kenosha, Wis.	Copper and brass mill products. Rods and shapes. Plates, sheet, strip, tubes, rods, and shapes, wire, brass bars, print rolls, commutators.
Beryllium Corp.	P.O. Box 1462, Reading, Pa.	Reading, Pa.	Beryllium copper products, complete line, except tube.
Bohn Aluminum & Brass Corp.	1400 Lafayette Bldg., Detroit 26, Mich.	Adrian, Mich.	Rod, extruded shapes, wire.
Bridgeport Brass Co., Division of National Distillers and Chemical Corporation. Bridgeport Rolling Mills Co. The Bristol Brass Corp. Cerro Copper & Brass Co., Division of Cerro Corp. Chase Brass & Copper Co., Inc.	30 Grand St., Bridgeport 2, Conn. Bridgeport 1, Conn. 580 Broad St., Bristol, Conn. 1111 Chouteau Avenue, St. Louis 2, Mo. 236 Grand St. Waterbury 20, Conn.	Indianapolis, Ind.; Seymour, Conn. (Seymour Mfg. Co.). Bridgeport, Conn. Bristol, Conn. Newark, Calif.; Monsanto, Ill.; Bellefonte, Pa. Waterbury, Conn.; Cleveland, Ohio.	Brass and copper mill products—sheet, strip, rod, wire, and tube. Alloy sheet and strip. Copper and brass mill products. Copper and brass tube, rod, shapes and electrolytic copper. Strip, tubes, rod, extruded shape, mechanical wire.
Chicago Extruded Metals Co. Detroit Gasket & Mfg. Co. Driver Harris Co. Wilbur B. Driver Co.	1821 S. 54th Ave., Cicero 50, Ill. Belding, Mich. P.O. Box 31, Harrison, N.J. 1875 McCarter Highway, Newark 4, N.J.	Cicero, Ill. Belding, Mich. Harrison, N.J. Newark, N.J.	Rod, shapes, wire. Do. Alloy wire and rod. Alloy rod and wire.
Eastwood Nealley Corp. The Electric Materials Co.	28 Joralemon St., Belleville 9, N.J. Clay & Washington Sts., North East, Pa.	Belleville, N.J. North East, Pa.	Alloy rod and wire. Bus bar, commutators, rod.
Handy & Harman	82 Fulton St., New York 28, N.Y.	New York, N.Y.; Bridgeport 1, Conn.	Alloy sheet and strip.
Hoskins Mfg. Co. Howe Sound Copper and Brass, Division of Howe Sound Company. C. G. Hussey & Co., Division of Copper Range Co. International Silver Co. Miller Company Mueller Brass Co. New England Brass Co. The New Haven Copper Co. Olin Mathieson Chemical Corp. Phelps Dodge Copper Products Corp.	4445 Lawton Ave., Detroit 8, Mich. Rolling Place, Springdale, Conn. 2850 Second Ave., Pittsburgh 19, Pa. 500 S. Broad St., Meriden, Conn. 99 Center St., Meriden, Conn. Port Huron, Mich. Taunton, Mass. 79 Main St., Seymour, Conn. Shamrock St., East Alton, Ill. 300 Park Ave., New York 22, N.Y.	Detroit, Mich. Springdale, Conn. Pittsburgh, Pa. Meriden, Conn. Meriden, Conn. Port Huron, Mich. Taunton, Mass. Seymour, Conn. New Haven, Conn.; East Alton, Ill. Los Angeles, Calif.; Bayway and South Brunswick, N.J.; Fort Wayne, Ind.	Cupronickel resistance wire rod. Copper, brass and bronze strip. Rod, sheet, strip. Alloy sheet. Sheet, strip, tube. Rod, shapes, tube. Sheet and strip. Plate, sheet, strip. Sheet, strip, rod, bus bar, shapes. Rod, tube, wire, bus bar, strip and special shapes.
Plume & Atwood Mfg. Co. H. K. Porter Company, Inc., Riverside-Alby Metal Division. Reading Tube Co., Division of Progress Mfg. Co. Revere Copper and Brass, Inc.	235 E. Main St., Thomaston, Conn. 1 Pavilion Ave., Riverside, N.J. Seventh & South Sts., Reading, Pa. 230 Park Ave., New York 17, N.Y.	Thomaston, Conn. Riverside, N.J. Reading, Pa. Los Angeles, Calif.; Chicago & Clinton, Ill.; Baltimore, Md.; New Bedford, Mass.; Detroit, Mich.; and Rome, N.Y.	Alloy sheet and strip. Alloy strip, rod, wire. Tube, pipe.
Scovill Mfg. Co.	99 Mill St., Waterbury 20, Conn.	Waterbury, Conn.; New Milford, Conn.	Plates, sheet, strip, tubes, rods and shapes, mechanical wire, bus bar, print rolls, commutators.
Triangle Conduit & Cable Co., Inc.	P.O. Box 711, Jersey Ave., New Brunswick, N.J.	New Brunswick, N.J.	Alloy sheet, rod, wire and brass and copper tube. Tube.
U.S. Mint Service, Treasury Dept. Volco Brass & Copper Co. Waterbury Rolling Mills, Inc. Western Electric Co., Inc. Westinghouse Electric Corp.	Washington 25, D.C. 801 Blvd., Kenilworth, N.J. P.O. Box 550, Waterbury 20, Conn. 222 Broadway, New York 38, N.Y. 700 Braddock Ave., East Pittsburgh, Pa.	Philadelphia, Pa.; Denver, Colo. Kenilworth, N.J. Waterbury, Conn. Chicago, Ill. East Pittsburgh, Pa.	Alloy sheet. Sheet, strip, rod, wire. Sheet and strip. Rod, sheet, tube. Do.
Wolverine Tube Division of Calumet & Hecla, Inc.	17200 Southfield Road, Allen Park, Mich.	Decatur, Ala.; Detroit, Mich.; Inkster, Mich.	Tube.

TABLE 75.—*Primary wire mills*

Company	General office	Location of fabricating plants
Anaconda Wire & Cable Co.....	Hastings-on-Hudson 6, N.Y.....	Great Falls, Mont.; Hastings-on-Hudson, N.Y.
Circle Wire & Cable Corp.....	5500 Maspeth Ave., Maspeth, L.I., N.Y.	Maspeth, N.Y.
Copperweld Steel Co.....	322 Frick Bldg., Pittsburgh 19, Pa.	Glassport, Pa.
General Cable Corp.....	730 Third Ave., New York 17, N.Y.	Los Angeles, Calif.; St. Louis, Mo.; Perth Amboy, N.J.; Rome, N.Y.
General Motors Corp.....	3044 W. Grand Blvd., Detroit 2, Mich.	Warren, Ohio.
Hatfield Wire & Cable Division of Continental Copper & Steel Industries, Inc.	Hillside, N.J.	Hillside, N.J.
The Okonite Co.—subsidiary of Kennecott Wire & Cable Corp., Kennecott Wire & Cable Division.	200 Passaic St., Passaic, N.J.	Phillipsdale, R.I.
Phelps Dodge Copper Products Corp.	300 Park Ave., New York 22, N.Y.	Fort Wayne, Ind.; Bayway, N.J.
Rods, Inc.....	23rd St., Marion, Ind.	Marion, Ind.
Rome Cable Corp.....	332-400 Ride St., Rome, N.Y.	Rome, N.Y.
Triangle Conduit & Cable Co., Inc....	P.O. Box 711, Jersey Ave., New Brunswick, N.J.	New Brunswick, N.J.
Western Electric Co., Inc.....	222 Broadway, New York 38, N.Y.....	Chicago, Ill.; Baltimore, Md.

TABLE 76.—Principal Government and industry groups concerned with the copper industry

	Address
Government Agencies:	
Bureau of the Census-----	Department of Commerce
Business and Defense Services Administration.	Do.
Bureau of Mines-----	Department of the Interior.
Geological Survey-----	Do.
Office of Minerals Exploration.	Do.
Office of Minerals Mobilization.	Do.
Agency For International Development.	Department of State.
Bureau of the Budget---	Executive Offices of the President.
Office of Emergency Planning.	Do.
Defense Materials Service.	General Services Administration.
Export-Import Bank-----	
Small Business Administration	
Tariff Commission-----	
National Associations:	
American Bureau of Metal Statistics.	50 Broadway, New York 4, N.Y., E. Boano, Director.
American Foundrymen's Society.	Golf and Wolf Roads, Des Plaines, Ill., W. W. Maloney, General Manager.
American Institute of Mining, Metallurgical and Petroleum Engineers, Inc.	The United Engineering Center, 345 East 47th St. New York, N.Y., Ernest Kirkendall, Secretary.
American Mining Congress.	1200 18th Street, N.W., Washington 6, D.C., Julian D. Conover, Secretary.
American Ordnance Association.	Mills Building, Washington 6, D.C., L. A. Codd, Executive Vice President.
American Society for Metals.	Metals Park, Novelty, Ohio, Allan Ray Putnam, Managing Director.
American Society for Testing Materials.	1916 Race St., Philadelphia 3, Pa., R. E. Hess, Acting Executive Secretary.
American Standards Association.	10 East 40th St., New York 16, N.Y., Roger Gay, Managing Director.
Brass and Bronze Ingot Institute.	300 West Washington St., Chicago 6, Ill.

TABLE 76.—Principal Government and industry groups concerned with the copper industry—Con.

	Address
Brookings Institution---	1775 Massachusetts Ave., N.W., Washington 6, D.C., Robert D. Calkins, President.
Copper and Brass Research Association.	420 Lexington Ave., New York 17, N.Y., T. E. Velfort, Managing Director.
Copper Institute-----	50 Broadway, New York 4, N.Y., E. Boano, Secretary.
Electrochemical Society--	1860 Broadway, New York 23, N.Y., Robert K. Shannor, Executive Secretary.
Engineers Council For Professional Development.	345 East 47th St., New York, N.Y., Elsie Murray, Executive, Secretary.
Engineers Joint Council--	345 East 47th St., New York, N.Y., Leroy K. Wheelock, Secretary.
Industrial Research Institute.	100 Park Ave., New York 17, N.Y., C. G. Worthington, Secretary-Treasurer.
International Copper Research Association Inc.	1271 Avenue of the Americas, New York 20, N.Y., Charles H. Moore, Director.
Metal Powder Industries Federation.	60 East 42nd St., New York 17, N.Y., Kempton H. Roll, Executive Secretary.
Mineralogical Society of America.	U.S. National Museum, Washington 25, D.C., George Switzer, Secretary.
Mining and Metallurgical Society of America.	11 Broadway, New York 4, N.Y.
National Association of Manufacturers.	2 East 48th St., New York 17, N.Y., Charles P. Sligh, Jr., Executive Vice President.
National Association of Purchasing Agents.	11 Park Place, New York 7, N.Y., G. W. Howard Ahl, Executive Secretary-Treasurer.
National Association of Secondary Material Industries.	271 Madison Avenue, New York 16, N.Y., M. J. Mighdoll, Executive Vice President.
National Electrical Manufacturers Association.	155 East 44th St. New York 17, N.Y., Joseph F. Miller, Managing Director.

TABLE 76.—Principal Government and industry groups concerned with the copper industry—Con.

	Address
National Foreign Trade Council.	111 Broadway New York 6, N.Y., William S. Swingle, President.
National Industrial Conference Board.	460 Park Ave., New York 22, N.Y., John S. Sinclair, President.
Non-Ferrous Founders Society, Inc.	309 Terminal Tower, Cleveland, Ohio, Ben J. Imburgia, Secretary.
Pressed Metal Institute..	3673 Lee Road, Cleveland 20, Ohio, H. A. Daschner, Managing Director.
Resources For The Future.	1775 Massachusetts Ave., N.W., Washington 6, D.C., John E. Herbert, Secretary.
Twentieth Century Fund.	41 East 70th St., New York 21, N.Y., August Heckscher, Director.
United Engineering Trustees.	345 East 47th St., New York, N.Y., Steven W. Marras, General Manager.
United States Copper Association.	50 Broadway, New York 4, N.Y., E. Boano, Secretary.
Wire Association.....	453 Main St., Stamford, Conn., Richard E. Brown, Executive Secretary.

Labor Organizations

Members of labor unions in copper mines, smelters, and refineries in the United States and Canada are represented largely in the International Union of Mine, Mill, and Smelter Workers, MMSW (I), an independent organization, and the United Steelworkers of America, which is an affiliate of the merged American Federation of Labor and Congress of Industrial Organizations (AFL-CIO), table 77. There are also a number of national, international, and local unions and associations connected with the various types of work at mines, mills, smelters, or refineries at particular locations. One large company in extending labor contracts relative to all its operations concluded agreements with 37 unions.

TABLE 77.—Organization data of principal unions connected with the copper industry

	Address
American Federation of Labor and Congress of Industrial Organizations: George Meany, President. Founded 1881—members 15,000,000; staff 600. Federation of national unions—135. Formed by merger of: The American Federation of Labor and the Congress of Industrial Organizations in 1955 (AFL-CIO).	815 16th Street, NW., Washington 6, D.C.
International Union of Mine, Mill and Smelter Workers, MMSW (I) John Clark, President. Founded 1893—members 100,000; locals 200. Independent.	941 East 17th Ave., Denver 18, Colo.
United Steelworkers of America: David J. McDonald, President. Founded 1936—members 960,000; locals 2,995. USA — affiliated with AFL-CIO.	1500 Commonwealth Bldg. Pittsburgh 22, Pa.
United Mine Workers of America: Thomas Kennedy, President. Founded 1890—members 600,000. UMWA—independent.	900 15th Street NW., Washington 5, D.C.
International Chemical Workers Union: Walter L. Mitchell, President. Founded 1944—members 81,144; locals 407. ICW — affiliated with AFL-CIO.	1659 West Market St. Akron 13, Ohio.
International Brotherhood of Electrical Workers: Gordon M. Freeman, President. Founded 1891—members 750,000; locals 1,754. IBEW — affiliated with AFL-CIO.	1200 15th Street, NW., Washington 5, D.C.

Source: Cohaney, Harry P., and Henry S. Rosenbloom. Directory of National and International Labor Unions in the United States, 1969. U.S. Department of Labor, Bull. 1267, December 1969.

Unions associated with the various operations of major copper producers in the United States and Canada are shown in table 78.

TABLE 78.—Union affiliations at major copper mines, smelters, and refineries

<i>United States:</i>		<i>Unions</i>
American Smelting & Refining Co.:		
Perth Amboy, N.J.	-----	International Union of Mine, Mill and Smelter Workers; United Auto Workers; International Union of Operating Engineers.
Baltimore, Md.	-----	International Union of Mine, Mill and Smelter Workers.
Hayden, Ariz., smelter	-----	Do.
Silver Bell, Ariz.	-----	United Mine Workers, District 50.
Tacoma, Wash.	-----	International Union of Mine, Mill and Smelter Workers.
Mission, Ariz.	-----	Laborers District, Council; International Union of Operating Engineers; International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America; Laborers' Union.
The Anaconda Co.:		
Anaconda, Mont.	-----	United Steelworkers of America.
Butte, Mont.	-----	International Union of Mine, Mill and Smelter Workers.
Great Falls, Mont.	-----	Do.
Anaconda, Butte, Great Falls, Mont.	-----	International Brotherhood of Electrical Workers; various trade or craft unions.
Yerington, Nev.	-----	AFL-CIO Council.
Calumet & Hecla, Inc., Calumet, Mich.	-----	United Steelworkers of America.
International Smelting & Refining Co., Perth Amboy, N.J. (Raritan).	-----	Do.
Cerro Corp.: Lewin Mathes Division, refinery St. Louis, Mo.	-----	Do.
Inspiration Consolidated Copper Co.:		
Inspiration, Ariz.	-----	Trade and craft unions, AFL-CIO; Brotherhood of Railroad Trainmen AFL-CIO.
Miami, Ariz.	-----	International Union of Mine, Mill and Smelter Workers; International Association of Machinists; Globe-Miami Metal Trades Council.
Kennecott Copper Corp.:		
Chino Mines Division	-----	International Union of Mine, Mill and Smelter Workers.
Nevada Mines Division, Ruth & McGill, Nev.	-----	Do.
Ray Division, Ray, Ariz.	-----	United Steelworkers of America.
Utah Copper Division:		
Bingham, Utah	-----	International Union of Mine, Mill and Smelter Workers.
Arthur & Magma mills	-----	Do.
Garfield Smelter, Refinery	-----	United Steelworkers of America.
Kennecott Refining Corp.: Anne Arundel County, Md.	-----	Do.
Magma Copper Co.:		
Magma Mine & Smelter, Superior, Ariz.	-----	International Union of Mine, Mill and Smelter Workers.
San Manuel Mine & Smelter, San Manuel, Ariz.	-----	International Union of Mine, Mill and Smelter Workers; Brotherhood of Locomotive Firemen and Enginemen.
Nassau Smelting & Refining Co.: Staten Island, N.Y.	-----	International Union of Mine, Mill and Smelter Workers.
Phelps Dodge Corp.:		
Ajo, Ariz.	-----	United Steelworkers of America.
Douglas, Ariz.	-----	International Union of Mine, Mill and Smelter Workers.
Morenci, Ariz.	-----	Do.
El Paso, Tex.	-----	Do.
Laurel Hill, Long Island City, N.Y.	-----	United Steelworkers of America.
All mine locations	-----	AFL-CIO trade and craft unions; Railroad workers unions.
Tennessee Corporation:		
Tennessee Copper Division, Ducktown and Copperhill, Tenn.	-----	International Chemical Workers Union.
Miami Copper Division, Miami, Ariz.	-----	International Union of Mine, Mill and Smelter Workers.
U.S. Metals Refining Co. (AMAX): Carteret, N.J.	-----	Do.
White Pine Copper Co., White Pine, Mich.	-----	United Steelworkers of America.
<i>Canada:</i>		
Hudson Bay Mining & Smelting Co., Flin Flon, Manitoba.	-----	Canada Labor Congress, AFL-CIO.
Noranda Mines, Ltd., Noranda, Quebec	-----	United Steelworkers of America.
Waite Amulet Mines, Ltd. (Noranda subsidiary)	-----	Do.
Canadian Copper Refiners, Ltd. (Noranda) Montreal East.	-----	Metal Refining Workers.
Gaspé Copper Mines, Ltd. (Noranda subsidiary)	-----	Murdochville Workers Association.
International Nickel Co. of Canada, Ontario	-----	International Union of Mine, Mill and Smelter Workers.

WORLD COPPER INDUSTRY

Growth of World Copper Industry

The cumulative world total of produced copper before 1800 has been estimated at less than 1 million tons, less than 1 percent of the total output from 1801 through 1960. Annual world production, about 18,000 tons in the first decade of the 19th century, increased steadily and reached about 545,000 tons in 1900. Accumulative world production from 1801 through 1900 totaled only 11.5 million tons. Since 1900 annual smelter production has increased nearly tenfold to almost 5 million tons in 1960.

Distribution of World Production

Copper was mined in 45 countries during 1960. Twenty-six of these countries produced more than 10,000 tons of copper, and eight—United States, Northern Rhodesia, Chile, U.S.S.R., Canada, Republic of the Congo, Peru, and Australia—exceeded 100,000 tons each; together they supplied 85 percent of the world total. Excluding the United States this major group produced 62 percent of the world output, and 13 companies in 5 of these countries accounted for 40 percent. Japan, China, Mexico, Republic of South Africa, and the Philippines are also important sources of copper.

Thirty countries had smelter production of copper in 1960. Twenty-three exceeded 10,000 tons, and nine—United States, Northern Rhodesia, Chile, U.S.S.R., Canada, West Germany, Republic of the Congo, Japan, and Peru—accounted for 89 percent of the world smelter output. Foreign countries supplied 64 percent.

Location of World Industry

Table 79 shows the 25 leading copper-producing companies in order of their 1960 output and their annual production from 1951 through 1963.

Table 80 lists smelting and refining plants outside the United States showing ownership, location, and capacity where available.

Important Foreign Copper Producing Companies

Following are descriptions of foreign copper-producing companies and their operations, compiled principally from these sources: Skinners' Mining Yearbook, 1961; Moody's Manual of Investments, Industrials, 1961; the World's Non-Ferrous Smelters and Refineries, 1960; and the latest available company reports.

NORTH AMERICA

Canada

Campbell Chibougamau Mines, Ltd.—55 Yonge St., Toronto, Ontario, Canada.—Incorporated March 10, 1950, in Province of Quebec. Owns control of Chibougamau Mining and Smelting Co., Inc.; Compania Minera Trans Rio, S.A. de C.V., to operate properties in Sonora, Mexico; and has management control of Chibougamau Venture, Ltd.

Capitalization:

Authorized 5,000,000 shares; outstanding June 30, 1961, 4,425,352.

Employees: June 30, 1961, 735; annual average.

Production, shipments:

	1959-60	1960-61
Copper.....tons..	16,137	18,744
Gold.....ounces..	38,377	34,415
Silver.....do....	310,564	397,726

Mines:

The company operates four mines and a 3,000-ton-per-day concentrator. The mines are the Main, Kokko Creek, Cedar Bay, and Henderson. Concentrate is shipped to Noranda Mines, Ltd., for smelting; blister is refined by Canadian Copper Refiners, Ltd.; and total production is sold by Noranda Mines, Ltd.

Canadian Copper Refiners, Ltd.—1700 Bank of Nova Scotia Bldg., 44 King St. West, Toronto 1, Ontario, Canada.—Incorporated February 6, 1929, in Canada, this is a subsidiary of Noranda Mines, Ltd. Owns an electrolytic copper refinery at Montreal East, Quebec, with an annual capacity of 240,000 tons. Production in 1960: 276,400 tons refined copper; 563,500 ounces gold, and 8,246,000 ounces silver. In addition selenium and tellurium are recovered, and copper sulfate is produced.

Capitalization:

20,000 shares, no par value; 18,455 shares held by Noranda Mines, Ltd.; balance, by Phelps Dodge Refining Corp.

The refinery receives most of its raw material from Noranda and its affiliates; has contract to refine blister produced by Hudson Bay Mining & Smelting Co., Ltd.

East Sullivan Mines, Ltd.—507 Place d'Armes, Montreal, Quebec, Canada.—Incorporated May 22, 1944, in Quebec, Canada. Affiliated with Sullivan Consolidated Mines, Ltd. Subsidiary is Sullico Mines, Ltd., formerly Quebec Copper Corp., Ltd.

Capitalization:

Authorized 4,500,000 shares; outstanding December 31, 1959, 4,250,000 shares. Sullivan Consolidated Mines, Ltd., owned 1,540,693 shares.

Production:

	1959	1960
Copper.....tons..	7,182	3,694
Zinc.....do....	1,756	4,948
Gold.....ounces..	4,239	4,125
Silver.....do....	146,822	155,557

Mines: See chapter 4.

Noranda Mines, Ltd., handles smelting of the concentrate, and refining and marketing of the copper and precious metals.

Falconbridge Nickel Mines, Ltd.—44 King St. West, Toronto 1, Canada.—Incorporated August 28, 1928, in Ontario, Canada. Controlled by Ventures, Ltd.

Capitalization:

Authorized 5,000,000 shares; outstanding, 3,766,922 shares.

TABLE 79.—Twenty-five leading copper producing companies in the world, in order of 1960 output, short tons

Company	Country	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Kennecott Copper Corp.	United States	430,187	444,582	429,052	338,749	370,487	402,309	387,291	318,732	235,228	384,088
Union Minière du Haut-Katanga	Republic of the Congo	211,596	226,797	236,020	246,685	258,680	272,786	264,860	259,686	309,088	331,434
Chile Exploration Co.	Chile	180,237	175,451	172,858	205,273	230,741	266,006	263,422	234,599	306,497	254,778
Phelps Dodge Corp. ¹	United States	250,692	226,584	223,554	222,137	257,477	270,181	246,418	218,574	193,557	234,081
Nchanga Consolidated Copper Mines, Ltd.	Northern Rhodesia	81,924	102,631	125,540	129,314	114,897	122,170	130,191	149,657	195,784	209,556
Braden Copper Co.	Chile	171,247	184,813	140,347	108,330	156,228	179,896	172,707	191,578	182,017	187,221
International Nickel Co. of Canada, Ltd.	Canada	122,168	117,568	122,337	129,522	134,156	141,448	148,028	92,493	142,082	154,679
Southern Peru Copper Corp. ²	Peru										145,115
The Anaconda Company	United States	54,372	57,802	74,471	75,669	124,016	127,951	117,069	111,956	90,528	133,695
The Rhokana Corp., Ltd. ³	Northern Rhodesia	90,299	80,923	88,805	91,606	81,490	93,262	94,878	84,473	109,796	121,839
Mufulira Copper Mines, Ltd. ⁴	do.	93,555	82,498	91,301	102,264	97,257	109,856	108,394	88,215	116,495	118,563
Roan Antelope Copper Mines, Ltd.	do.	88,352	86,537	104,353	98,829	91,361	97,565	92,881	77,121	105,786	100,935
Andes Copper Mining Co.	Chile	44,945	51,565	45,059	42,257	44,616	43,020	43,277	35,981	60,314	86,859
San Manuel Copper Corp.	United States						39,076	59,899	74,701	46,170	81,724
Mount Isa Mines, Ltd.	Australia			17,470	22,308	24,020	32,434	30,936	43,241	62,518	79,252
Bancroft Mines, Ltd.	Northern Rhodesia							15,467	6,215	40,492	60,363
Boliden Mining Co. ⁵	Sweden	29,762	31,967	33,400	34,502	35,130	35,483	36,299	37,710	44,551	41,334
Hudson Bay Mining & Smelting Co., Ltd.	Canada	39,541	39,724	39,962	45,010	46,667	46,341	44,364	45,456	43,914	40,870
Inspiration Consolidated Copper Co.	United States	39,125	42,535	39,703	34,096	38,114	37,083	35,728	41,821	47,012	40,400
O'okiep Copper Co., Ltd.	Union of South Africa	22,560	24,921	24,379	28,915	30,900	32,472	30,553	36,570	37,785	40,116
White Pine Copper Co.	United States					31,921	37,758	34,459	41,027	34,907	37,463
Gaspé Copper Mines, Ltd.	Canada					6,692	27,617	17,693	35,266	33,412	34,597
Cerro Corp.	Peru	26,798	22,554	25,384	29,029	34,671	34,100	45,345	41,441	36,883	33,000
Tennessee Corp.—Miami Copper Division. ⁶	United States	50,834	50,270	46,621	29,135	48,337	49,762	43,690	33,369	31,536	28,750
Noranda Mines, Ltd. (Horne mine)	Canada	25,315	25,380	15,396	21,882	27,734	26,308	27,287	28,803	27,086	25,779

¹ Includes production from Moctezuma, Mexico, and copper produced from purchased ores.² Content of blister copper.³ Excludes Nchanga.⁴ Blister only; in addition small quantities were produced during 1951-52 from ore treated elsewhere.⁵ Includes secondary.⁶ Division of Tennessee Corp. since June 11, 1960; production for entire year. Previously Miami Copper Co. and subsidiaries.

Source: American Bureau of Metal Statistics Yearbooks.

TABLE 80.—Foreign copper smelters and refineries

Location	Company	Smelters		Refineries	
		Location of plant	Capacity, tons of charge	Location of plant	Capacity short tons
North America:					
Canada.....	Canadian Copper Refiners, Ltd.....	Falconbridge, Ontario.....	770,000	Montreal, East Quebec.....	284,400
	Falconbridge Nickel Mines, Ltd.....	Murdochville, Quebec.....	260,000		
	Gaspé Copper Mines, Ltd.....	Flin Flon, Manitoba.....	575,000		
	Hudson Bay Mining & Smelting Co., Ltd.....				
	International Nickel Co. of Canada, Ltd.....	(Copper Cliff, Ontario.....	5,600,000	Copper Cliff, Ontario.....	168,900
	Noranda Mines, Ltd.....	(Coniston, Ontario.....	1,000,000		
	American Smelting and Refining Company.....	Noranda, Quebec.....	1,600,000		
Mexico.....	Cia. Minera de Santa Rosalia S.A.....	San Luis Potosi.....	300,000		
	Cobre de Mexico, S. A.....	Santa Rosalia, Baja California.....	120,000	Atzacapotzalco, District Federal.....	43,000
	Compania Minera de Cananea, S.A. de C.V.....	Cananea, Sonora.....	290,000		
	Mazapil Copper Co., Ltd.....	Concepcion del Oro, Zacatecas.....	200,000		
South America:					
Chile.....	Andes Copper Mining Co.....	Potrerrillos.....		Potrerrillos.....	
	Braden Copper Co.....	Caletones.....		Caletones.....	180,000
	Chile Exploration Co.....	Chuquicamata.....		Chuquicamata.....	
	Cia. Minera Disputada de las Condes, S.A.....	Chagres.....			
	Paipote National Smelter.....	Paipote.....			
	Cerro de Pasco Corp.....	Oroya.....		Oroya.....	40,000
	Southern Peru Copper Corp.....	Ilo.....			
Europe: ¹					
Austria.....	Montanwerke Brillegg, G.M.B.H.....	Hoboken.....		Brillegg, Tirol.....	11,000
Belgium.....	Soc. Generale Metallurgique de Hoboken, S.A.....			Olen.....	193,000
Finland.....	Outokumpu Oy.....	Harjavalta.....		Pori.....	37,000
France.....	Campagne Generale D'Electrolyse Du Palais.....	Palais-sur-Vienne.....		Palais-sur-Vienne.....	33,000
East Germany.....	Kupferwerk Isenburger A.G.....	Isenburger, Harz.....		Isenburger, Harz.....	
	Mangfeldscher Kupferschieferbergbau A.G.....	Eisleben.....		Hettstedt.....	
West Germany.....	Duisburger Kupferhütte.....	Duisburg.....		Lünen.....	35,000
	Hüttenwerke Kayser Aktiengesellschaft.....	Lünen.....			
	Metallhüttenwerke Lübeck G.M.B.H.....	Lübeck (Herrenwyk).....		Lübeck (Herrenwyk).....	14,000
	Norddeutsche Affinerie.....	Hamburg.....		Hamburg.....	165,000
	Stadtberger Kupferhütte.....	Niedermarsberg, Nordrhein-Westfalen.....			
Norway.....	Zinnwerke, Wilhelmsburg, G.M.B.H.....	Hamburg.....		Hamburg.....	26,000
	Falconbridge Nikkelverk A/S.....	Kristiansand.....		Kristiansand.....	18,000
	A/S Sulitjelma Gruber.....	Sulitjelma.....			
Spain.....	Electrolisis de Cobre S.A.....	Barcelona and Palencia.....		Palencia.....	13,000
	Compania Espanola De Minas de Rio Tinto S.A.....	Huelva.....			
	Industrias Reunidas Minero Metalurgicas S.A.....			Asua, Vizcaya.....	15,000
	Soc. Espanola de Construcciones Electro-Mecanicas S.A.....			Cordoba.....	40,000
	Soc. Industrial Asturiana.....			Santa Barbara (Oviedo).....	3,000
Sweden.....	Bolidens Gruvaktiebolag.....	Rönnskär.....		Rönnskär.....	50,000
	Reymersholms Gamla Industri Aktiebolag.....	Hälsingborg and Oskarshamn.....			
United Kingdom.....	Actid, Limited.....			High Blantyre, Scotland.....	
	Thomas Bolton & Sons, Ltd.....			Widnes, Lancaster and Froghall, Stafford, England.....	22,000
	British Copper Refiners, Ltd.....			Prescot, Lancaster, England.....	112,000
	Elkington Copper Refiners, Ltd.....			Walsall, Stafford, England.....	26,000
	Enfield Rolling Mills, Ltd.....			Brimsdown, England.....	73,000
	Imperial Chemical Industries, Ltd.....			Birmingham, England.....	8,000
	Rudnici Bakra i Topionice Bor.....	Bor.....		Bor.....	61,000
Yugoslavia.....					
Asia:					
India.....	Indian Copper Corp.....	Moubandar, Bihar.....		Moubandar, Bihar.....	9,000
Japan.....	Dai Nippon Kogyo K.K.....	Hasse, Akita-ken.....			
	Dowa Mining Co., Ltd.....	Kosaka, Akita-ken.....		Kosaka, Akita-ken.....	20,000
	Do.....	Okayama, Okayama-ken.....		Okayama, Okayama-ken.....	6,000
	Furukawa Electric Co., Ltd.....			Nikko, Tochigi-ken.....	40,000
	Furukawa Mining Co., Ltd.....	Ashio, Tochigi-ken.....			
	Mitsubishi Metal Mining Co., Ltd.....	Osarizawakosen, Akita-ken; Naoshima-cho, Kagawa-ken.....		Kita-ku, Osaka City.....	47,000
	Mitsui Mining & Smelting Co., Ltd.....	Hibi, Okayama-ken.....		Takehara, Hiroshima-ken.....	37,000
	Nippon Mining Co., Ltd.....	Ogoyamachi, Ishikawa-ken.....			
	Do.....	Hitachi, Motoyama, Ibaraki-ken.....		Hitachi, Ibaragi-ken.....	46,000
	Do.....	Saganoseki, Oita-ken.....		Saganoseki, Oita-ken.....	46,000
	Sumitomo Metal Mining Co., Ltd.....	Setose, Hokkaido-cho.....			
Turkey.....	Ergani Bakir Isletmesi Muessesesi.....	Beshidozan, Ehime-ken.....		Beshi-Ehime-ken.....	46,000
	Murgul Bakir Isletmesi.....	Damar-Maden.....		Maden.....	7,000
				Damar.....	6,000
				Istanbul.....	6,000
	Rabak Elektrolitik Bakir Fabriksi.....			Istanbul.....	6,000

¹ U.S.S.R. copper smelters listed separately.

TABLE 80.—Foreign copper smelters and refineries—Continued

Location	Company	Smelters		Refineries	
		Location of plant	Capacity, tons of charge	Location of plant	Capacity short tons
Africa:					
Republic of the Congo.	Union Minière du Haut-Katanga.....	Lubumbashi, Katanga.....		Jadotville, Shituru.....	160,000
Northern Rhodesia.	Mufulira Copper Mines, Ltd.....	Jadotville, Katanga.....		Lulu.....	55,000
	Nchanga Consolidated Copper Mines, Ltd.	Lulu, Katanga.....		Mufulira.....	114,000
	Ndola Copper Refineries, Ltd.....	Mufulira.....		Chingola.....	76,500
	Rhodesia Copper Refineries, Ltd.....			Ndola.....	110,000
Southern Rhodesia.	Rhokana Corporation, Ltd.....	Nkana.....		Nkana.....	160,000
	Roan Antelope Copper Mines, Ltd.....	Luanshya.....			
	Messina Rhodesia Smelting & Refining Co.	Alaska.....			
	Messina (Transvaal) Development Co., Ltd.			Messina, Transvaal, Republic of South Africa.	16,000
Uganda.....	O'okiep Copper Co., Ltd.....	Messina, Transvaal, Republic of South Africa.			
	Tsumeb Corp., Ltd.....	Nababiep, Namaqualand.....			
Oceania:	Kilembe Mines, Ltd.....	Tsumeb.....			
Australia.....	Copper Refineries Pty., Ltd.	Finja.....		Townsville, Queensland.....	80,000
	Electrolytic Refining & Smelting Co. of Australia Pty., Ltd.	Port Kembla, New South Wales.....		Port Kembla, New South Wales.....	35,000
Tasmania.....	Mount Isa Mines, Ltd.....	Mount Isa, Queensland.....			
	Mount Morgan, Ltd.....	Mount Morgan, Queensland.....			
	Mount Lyell Mining & Railway Co., Ltd.	Queenstown.....		Queenstown.....	15,000

Employees: December 31, 1960, 4,522.

Production, deliveries:	1959	1960
Nickel..... tons..	29,207	32,501
Copper..... do.....	16,364	18,006
Cobalt..... pounds..	732,000	827,000

Mines and plants:

Falconbridge owns properties in the Sudbury Basin, Ontario. The company mill, 6,500 tpd, and smelter are on the main property at Falconbridge. The matte is treated at the Kristiansand refining plant in Norway owned by the Norwegian subsidiary, Falconbridge Nikkelverk Aktieselskap.

Gaspé Copper Mines, Ltd.—Noranda, Quebec, Canada.—Incorporated in Quebec in 1947, this is controlled by Noranda Mines, Ltd.

Capitalization:

Authorized, 3,000,000 shares; issued, 2,650,000 shares; par \$1. Noranda Mines, Ltd., owns 95.5 percent of stock.

Production:	1959	1960
Copper..... tons..	45,039	83,497
Gold..... ounces..	7,807	10,200
Silver..... do.....	462,610	579,800

Mines and plants:

Concentrator has capacity of 6,500 tons of ore daily. Concentrates smelted, refined, and marketed by Noranda Mines, Ltd.

Geco Mines Ltd.—44 King St. West, Toronto 1, Ontario, Canada.—Incorporated in Ontario, Canada, October 16, 1953.

Capitalization:

Authorized, 3,000,000 shares; outstanding, 3,000,000 shares; par \$1. 795,400 shares owned by Mining Corp. of Canada, Ltd., and associates.

Production:	1959	1960
Copper..... tons..	25,903	21,761
Zinc..... do.....	23,082	28,362
Silver..... ounces..	1,363,525	1,391,177
Gold..... do.....	5,706	5,071

Mines and plants: See chapter 4.

Granby Mining Co., Ltd.—1111 West Georgia St., Vancouver, B.C.—Incorporated March 29, 1901, by special act of parliament of British Columbia as Granby Consolidated Mining, Smelting, and Power Co., Ltd.; present name adopted March 20, 1959.

A subsidiary, Phoenix Copper Co., Ltd., operates the Copper Mountain mine about 150 miles east of Vancouver, B.C. The concentrator is at Allenby, 8 miles north of the mine. Concentrate is shipped to the American Smelting & Refining Co. smelter at Tacoma, Wash. The company owns a power plant near Princeton, B.C.

Capitalization:

Authorized 2,000,000 shares, outstanding 454,261 shares par \$5.

Production:	1959	1960
Copper..... tons..	1,151	1,962
Gold..... ounces..	4,447	5,742
Silver..... do.....	21,832	36,467

Howe Sound Co.—238 North 21st West, Salt Lake City, Utah.—Incorporated June 30, 1958, in Delaware and merged with Howe Sound Co. Incorporated in Maine in 1903 and Haile Mines, Inc. Incorporated in Delaware in 1934. The company operates directly and through subsidiaries gold, silver, and base metal mines in the United States, Canada, and Mexico.

Capitalization:

Authorized, 5,000,000 shares; outstanding, December 31, 1960, 3,011,797 shares; par \$1.

Mines: The company and subsidiaries have four mines:

Britannia Mine.—Owned and operated by Britannia Mining & Smelting Co., Ltd., a wholly owned subsidiary. Property is 20 miles north of Vancouver, B.C., on Howe Sound; copper and zinc are produced. A concentrator built in 1922 has capacity of 6,000 tons of ore daily.

El Potosi Mine.—Operated by El Potosi Mining Co., 95½ percent owned. The El Potosi mine, in the Santa Eulalia Mining District, State of Chihuahua, Mexico, has been one of the great world's lead-silver mines.

Mill capacity is 1,700 tons of ore daily. 1958 production of ore averaged 14,000 tons per month.

Three Kids Mine.—Operated by Manganese, Inc., wholly owned subsidiary. Mine at Henderson, Nev., produces metallurgical-grade manganese.

Hamme Mine.—Operated by Tungsten Mining Corp., wholly owned subsidiary. Property near Henderson, N.C., produces tungsten concentrate. Mill capacity is 900 tons of ore daily.

Hudson Bay Mining and Smelting Co.—500 Royal Bank Bldg., Winnipeg, Manitoba, Canada.—Incorporated December 27, 1927, in the Dominion of Canada, this is essentially an operating company engaged in mining and processing copper-zinc ores and marketing the products—principally copper, zinc, gold, and silver. Cadmium, selenium, and tellurium are also recovered and sold. A wholly owned subsidiary produces electricity, most of which is used by company operations. Some is distributed to local users. Company subsidiaries are:

Churchill River Power Co., Ltd.; 100 percent owned.

Northern Manitoba Power Co., Ltd.

Northern Power Co., Ltd.

Flexar Mines, Ltd.; 80 percent owned; inactive.

Hudson-Yukon Mining Co., Ltd.; 92.53 percent.

Hudson Bay Exploration & Development Co., Ltd.

Hudson Bay Air Transport, Ltd.; 71.27 percent.

Capitalization:

Authorized, 3,000,000 shares; outstanding, 2,757,973 shares; no par.

Employees: Average in 1960, 2,731.

Production:	1959	1960
Copper.....tons..	44,124	39,859
Zinc.....do.....	62,582	68,093
Cadmium.....pounds..	322,792	366,636
Gold.....ounces..	101,814	105,530
Silver.....do.....	1,553,574	1,645,554
Selenium.....pounds..	130,588	88,500
Ore mined.....tons..	1,683,690	1,698,256

Mines:

The Flin Flon mines include the Schist Lake; Birch Lake, closed April 1960; Coronation; Chisel Lake; Stall Lake; Ghost Lake; and Osborne Lake, inactive.

Plants:

The concentrator, 6,200 tons ore capacity, produces copper concentrate, zinc concentrate, and a tailing product for cyanidation. The company copper smelter has an annual charge capacity of 575,000 tons, and the electrolytic zinc plant capacity is estimated at 69,350 tons of slab zinc. The company also has a zinc fuming plant, a cadmium plant, and a cyaniding plant. The blister copper produced is refined by Canadian Copper Refiners, Ltd., a Noranda Mines, Ltd., subsidiary.

International Nickel Co. of Canada, Ltd.—General office: Copper Cliff, Ontario. Toronto office: 55 Yonge St., Toronto 1, Ontario.—Incorporated July 25, 1916, in Canada. International Nickel is both an operating and holding company, owning 100 percent of the voting control of the following subsidiaries as of December 31, 1960:

Alloy Metals Sales Ltd., Canada.

Anglo-Canadian Mining & Refining Co., Ltd., Canada.

Geo. Gordon & Co., Ltd., Ontario.

The International Nickel Co., Inc., Del.

International Nickel Co. (Mond), Ltd., Great Britain.

Henry Wiggin & Co., Ltd., Great Britain.

Mond Nickel (Retirement System) Trustees, Ltd., Great Britain.

The Clydach Estates, Ltd., Great Britain.

Canadian Nickel Products, Ltd., Canada.

Canadian Nickel Co., Ltd., Canada.

The Huronian Co., Ltd., Ontario, Can.

Southern Mining & Development Co., Ltd., Canada.

The Upper Spanish Improvement Co., Ltd., Ontario.

Capitalization:

Authorized, 36,000,000 shares; outstanding Dec. 31, 1960, 29,196,118 shares; no par.

Employees: December 31, 1960, 30,447.

Production:	1959	1960
Ore mined.....tons..	15,316,000	16,768,000
Copper, refined....do....	126,225	146,270
Nickel deliveries all forms.....tons..	158,520	175,940
Cobalt.....pounds..	2,400,000	2,360,000
Gold.....ounces..	38,300	50,100
Silver.....do.....	1,200,000	1,510,000
Platinum metals....do....	384,600	359,300

Mines and plants:

The company owns approximately 130,000 acres of mineral lands near Sudbury, Ontario, Canada. The ores come from the Sudbury Nickel Range. Some of the mines are the Froid-Stobie, Creighton, Levack, Garson, and Murray—all in the district of Sudbury. The ores contain sulfides of copper, nickel, and iron. The plant at Copper Cliff includes a concentrator, roasting furnaces, 9 reverberatory furnaces, 23 basic converters, a sintering plant, and a copper-nickel separation plant. A copper refinery with a precious metals recovery plant is also at Copper Cliff. The nickel refinery with a cobalt producing plant is at Port Colborne; and there are a sintering plant, four blast furnaces and five basic converters at Coniston. A 6,000-ton-per-day mill began operating in June 1959 at Levack.

There is also a new nickel refinery at Thompson, Manitoba, having an annual capacity of 75,000,000 pounds of nickel, that began operations in 1961; a nickel refinery at Clydach, Wales; and a precious metals refinery at Acton, England, that produces platinum metals, gold, and silver from byproduct materials obtained from other plants.

International Nickel produces nickel, nickel oxide, and nickel salts; copper and various alloys of nickel and copper; cobalt, gold, silver, selenium, and tellurium; and platinum, palladium, rhodium, ruthenium, and iridium. This company is the foremost producer of nickel in the world.

Manitou-Barvue Mines, Ltd.—25 Adelaide St. W., Toronto, Ontario, Canada. Incorporated in Ontario November 10, 1910, as Barvue Mines, Ltd.; adopted present name December 31, 1958, on acquisition of Golden Manitou Mines, Ltd.

Capitalization:

Authorized, 8,500,000 shares; outstanding February 1, 1960, 1,554,491 shares; par \$1.

Production:	1958	1959
Zinc.....tons..	11,154	10,193
Copper.....do....	2,984	2,584
Lead.....do.....	1,054	1,106
Silver.....ounces..	654,819	751,659
Gold.....do.....	13,667	10,583

Mines and plants:

The Golden Manitou mine is in Bourlamaque Township, Quebec, Canada. Daily mill capacity is 550 tons of zinc ore and 850 tons of copper ore. The Barvue zinc-lead-silver properties are in Barraute Township, Quebec, about 35 miles north of the Golden Manitou mine. Rated capacity of this mill is 6,000 tons of ore per day.

Maritimes Mining Corp., Ltd.—Head office: Bathurst, New Brunswick, Canada.—Incorporated in New Brunswick, Canada, December 8, 1952, and

merged with Bathurst Mining Corp., Ltd., December 30, 1955.

Capitalization:

Authorized and outstanding, 10,000,000 shares. Falconbridge Nickel Mines, Ltd., owns a substantial interest.

Employees: December 31, 1960, 328.

Production:	1958	1959	1960
Copper.....tons..	12,562	12,189	12,004
Gold.....ounces..	4,074	4,819	5,244

Mines and mill:

All production is from the Tilt Cove mine. Exploration and development work are being conducted at the Gullbridge mine and two properties in New Brunswick. The Tilt Cove mill has a daily capacity of 2,000 tons of ore, and the concentrate produced is shipped to the Gaspé Copper Mines smelter at Murdochville, Quebec.

Noranda Mines, Ltd.—Bank of Nova Scotia Bldg., 44 King St. West, Toronto 1, Ontario, Canada.—Incorporated May 1, 1922, in Ontario, Canada. The company is both an operating and holding company and with its affiliates is engaged in mining, milling, smelting, refining, and marketing. Subsidiaries and affiliates are:

Amulet Dufault Mines, Ltd.
Anglo Porcupine Gold Mines, Ltd.
Arbutus Porcupine Mines, Ltd.; 100 percent owned.
Aunor Gold Mines, Ltd.; 55 percent owned.
Canada Wire and Cable Co., Ltd.; 70 percent owned.
Canadian Copper Refiners, Ltd.; 92.27 percent owned.
Cia. Minera Las Cuevas, S.A.; Mexico.
Empresa Minera de El Sethentrion; 60 percent owned.
Gaspé Copper Mines, Ltd.; 100 percent owned.
Hallnor Mines, Ltd.; 94 percent owned.
Noranda Copper & Brass Co., Ltd.; 60 percent owned.
Noranda Exploration Co., Ltd.; 100 percent owned.
Noranda Hotel Co., Ltd.; 100 percent owned.
Orchan Uranium Mines; 40 percent owned.
Pamour Porcupine Mines, Ltd.; 46 percent owned.
Quebec Iron Foundries, Ltd.
Quebec Smelters, Ltd.; 100 percent owned.
Waite Amulet Mines, Ltd.; 67.5 percent owned.
West Mac Donald Mines, Ltd.; 51 percent owned.

Capitalization:

Authorized, 6,000,000 shares; outstanding December 31, 1960, 4,479,894 shares; no par.

Production, Horne mine:	1959	1960
Copper.....tons..	26,480	¹ N.A.
Gold.....ounces..	186,639	209,860
Silver.....do.....	987,000	N.A.

¹ Not available.

Mines and plants:

The company operates the Horne Mine in Rouyn Township, Temiscamingue County, Province of Quebec. The mine has been developed to about 6,000 feet by various shafts. The company concentrator, capacity 3,500 tons ore daily, and smelter, capacity 3,500 tons charge daily, are in the town of Noranda and treat custom ore and concentrate as well as the company ore. There is also a 500-ton-per-day cyaniding plant to treat the pyrite tailing from the flotation plant for further recovery of gold. Blister copper produced is refined by Canadian Copper Refiners, Ltd., a wholly owned subsidiary at Montreal East, Quebec.

Normetal Mining Corp.—44 King St. West, Toronto 1, Ontario, Canada.—Incorporated September 8, 1931, in Canada. Controlled by Mining Corp. of Canada, which owns 1,812,888 shares.

Capitalization:

Authorized, 4,000,000 shares; outstanding December 31, 1960, 3,757,012 shares; no par.

Production:	1959	1960
Copper.....tons..	11,257	10,736
Zinc.....do.....	9,442	10,313
Gold.....ounces..	6,833	6,361
Silver.....do.....	582,577	515,798

Opemiska Copper Mines (Quebec), Ltd.—25 King St. West, Toronto 1, Ontario, Canada.—Incorporated August 21, 1937, in Canada. Ventures, Ltd., has a 35-percent stock interest.

Capitalization:

Authorized, 6,000,000 shares; outstanding, 5,515,000 shares; par \$1.

Production:	1959	1960
Ore.....tons..	443,444	751,453
Copper.....do.....	14,272	20,569
Gold.....ounces..	13,080	17,813
Silver.....do.....	169,300	242,646

Mine and mill:

The property consists of 58 mining claims containing copper and gold deposits in the Chibougamau District, Quebec. Three shafts have been sunk at the Springer and Perry mines. The mill has a capacity of 2,000 tons of ore per day; concentrates are shipped to the Noranda smelter.

Queмонт Mining Corp., Ltd.—44 King St. West, Toronto 1, Ontario, Canada.—Incorporated June 8, 1928, in Canada as Mining Corp. (Quebec), Ltd.; present name adopted March 6, 1929. The company is controlled by Mining Corp. of Canada, Ltd. It owns 103,000 shares of Geco Mines, Ltd., and share interests in other companies.

Capitalization:

Authorized, 2,500,000 shares; outstanding, 2,102,168 shares; no par.

Production:	1959	1960
Ore treated.....tons..	850,099	856,862
Copper.....do.....	10,373	10,209
Zinc.....do.....	16,035	16,591
Gold.....ounces..	121,867	103,222
Silver.....do.....	395,276	392,754

Mine and mill:

In 1928, Mining Corp. of Canada, Ltd., acquired an interest in the Murray copper-gold property and Queмонт Mining Corp., Ltd., was formed to develop it. The main five-compartment shaft has been deepened to 4,150 feet for developing lower levels. The concentrator has a daily capacity of 2,300 tons of ore, and there is a cyaniding plant for removing gold from the pyrite tailing.

Sheritt Gordon Mines, Ltd.—25 King St. West, Toronto 1, Ontario, Canada.—Incorporated July 5, 1927, in Ontario. Wholly owned subsidiaries are: Sheritt Gordon Airtransport, Ltd.; Michipicoten Holdings, Ltd.; Lauri River Power Co., Ltd.; and Sherlynn Mines, Ltd. (83 percent). Through Michipicoten Holdings, Ltd., Sheritt Gordon has an 82.7 percent interest in the Ruth and Lucy iron property in the Michipicoten District.

Capitalization:

Authorized, 12,000,000 shares; outstanding, 11,333,318 shares; par \$1.

Employees: December 31, 1960, 1,181.

Production:	1959	1960
Nickel.....tons..	12,406	11,629
Copper.....do.....	5,171	5,495
Cobalt.....pounds..	314,343	310,410
Ammonium sulfate.....tons..	113,890	123,841

Mines and plants:

The company has 405 claims at Lynn Lake, Granville Lake district, Northern Manitoba. The property is developed by three shafts, the deepest being 2,350 feet. The concentrator at Lynn Lake has a daily capacity of 3,400 tons of ore. Nickel concentrate is shipped to the company nickel refinery at Fort Saskatchewan, Alberta; copper concentrate is smelted by Hudson Bay Mining & Smelting Co., Ltd.

Waite Amulet Mines, Ltd.—Head office: Noranda, Quebec, Canada.—Incorporated June 23, 1927, in Canada as Waite-Ackerman-Montgomery Mines, Ltd.; name changed August 1933. Controlling interest, 67.5 percent, held by Noranda Mines, Ltd. The company has substantial share interests in Amulet Dufalt Mines, Ltd.; Geco Mines, Ltd.; and Mining Corp. of Canada, Ltd.

Capitalization:

Authorized, 3,500,000 shares; outstanding, 3,300,000 shares; no par.

Production:

	1959	1960
Copper.....tons--	12,830	13,153
Zinc.....do--	8,546	7,350
Gold.....ounces--	7,132	8,345
Silver.....do--	198,956	193,877
Sulfur.....tons--	25,728	26,329

Mine and mill:

The Waite Amulet mine is 9 miles north of Noranda, Quebec, in Duprat and Dufresnay townships. The property is held under patented mining claims covering 2,679 acres. The mill has a daily capacity of 2,000 tons of ore and produces copper, zinc, and pyrite concentrates. Copper concentrate is shipped to the Noranda smelter; zinc and pyrite concentrates are sold for export.

Haiti

Consolidated Haliwell Ltd.—Head office: 1374 Sherbrooke St. West, Montreal, Quebec, Canada.—Incorporated in 1933 in Quebec, Canada. A wholly owned Haitian subsidiary, Sedren, S.A., is exploring and developing a concession about 100 square miles in area in the Terre Neuve district, Republic of Haiti. A 500-ton-per-day mill was scheduled for production in 1960.

Capitalization: Authorized, 10,000,000 shares; issued, 9,655,000 shares; par \$1.

Mexico

Cobre de Mexico, S.A.—Poniente 44, No. 3310, Mexico 16, D.F.—Established in 1943.

Capital: Authorized, Mexico \$20,000,000; all is issued.

Plant:

An electrolytic copper refinery in Mexico City refines blister copper from the smelter at Cananea, Sonora. Produces cathodes and wirebars, makes copper sulfate from scrap copper, and recovers commercial grade selenium from electrolytic tank slimes.

Compagnie Minera Santa Rosalia, S.A.—Articulo 123, No. 37, 50 Piso, Mexico, D.F.—This is a semi-official agency of the Mexican Government, conducting studies to develop low-cost methods to concentrate and smelt complex low-grade copper ores from numerous but small occurrences in the Santa Rosalia district. Production from 1909 until 1954 averaged 12,000 tons a year from the Boleo mine. Copper smelter is at Santa Rosalia, Baja California, Mexico.

Greene Cananea Copper Co.—25 Broadway, New York 4, N.Y.—Incorporated December 26, 1906, in Minnesota.

Capitalization:

Authorized, 600,000 shares; outstanding, 500,000

shares of which 99.41 percent is owned by The Anaconda Company; par \$100.

Mines and plant:

The mines, concentrator, and smelter of the operating subsidiary, Cia. Minera de Cananea, S.A. de C.V., formerly The Cananea Consolidated Copper Co., S.A., are at Cananea, Sonora, Mexico. The concentrator handles 16,000 tons of ore daily, and the smelter has an annual charge capacity of 290,000 tons. Production in 1959 was 32,182 tons copper, 433,771 ounces silver, and 9,030 ounces gold.

In 1952 Cananea Consolidated Copper Co., S.A., acquired a 25-percent stock interest in Cobre de Mexico, S.A., and in 1953 purchased a 12-percent stock interest in the Conductores Electricos, S.A., wire mill in Mexico City. See chapter 3.

Mazapil Copper Company, Ltd.—8 Great Winchester St., London, England.—Registered April 21, 1896, as a reconstruction of a company of the same name.

Capitalization:

£1,000,000; issued, £600,000 ordinary stock transferable in units and multiples of £1; unissued, 400,000 ordinary shares of £1.

Mines and plants:

The company has copper, lead, and zinc mines in the State of Zacatecas, Mexico, with a concentrator and copper and lead smelters at Concepcion del Oro. The company operates the copper mines and leases the lead-zinc ores in the La Leona and Salaverna mines to Compania Minera de Penoles.

The copper ores are smelted and sold in matte form.

In 1959 copper production consisted of 6,267 tons of copper matte averaging 39.8 percent copper and 5,257 tons of concentrate containing 20.3 percent copper. See chapter 3.

SOUTH AMERICA**Chile**

Andes Copper Mining Co.—25 Broadway, New York.—Incorporated in Delaware in 1916 under perpetual charter to acquire copper properties in Chile, this is primarily an operating company and is controlled by The Anaconda Company, which as of December 31, 1960, owned 99.446 percent of the outstanding stock.

Capital:

Authorized, 3,600,000 shares at \$14 each; outstanding December 31, 1958, 3,582,379 shares.

Mines and plants:

Owns the El Salvador and Potrerillos mines in the Province of Atacama and a concentrator and smelter. The Potrerillos mine closed in 1959. Sulfide ores are smelted, and the blister copper is shipped to the United States for refining. A molybdenum recovery plant completed in 1959 operated satisfactorily in 1960. Copper production was 86,859 tons in 1960, compared with 60,314 tons in 1959.

Braden Copper Co.—161 East 42nd St., New York, 17.—Incorporated June 23, 1904, in Maine. The company is a wholly owned subsidiary of Kennecott Copper Corp.

Capitalization:

\$2,332,030, in shares of \$10 each; all shares are issued and fully paid.

Production of copper:

1958, 191,578 tons; 1959, 182,017 tons; 1960, 187,221 tons. Virtually all of the Braden copper in 1960 went to the European market; 41 percent was fire refined, 40 percent was electrolytic, and 19 percent was sold as blister.

Mines and plants:

The El Teniente mine near Sewell, Province of O'Higgins, is the largest underground producer of copper in the world. Facilities include a concentrator, molybdenum recovery plant, smelter, fire refinery, and hydroelectric power plant.

Chile Exploration Co.—25 Broadway, New York 4.—Incorporated January 11, 1912, in New Jersey. Chile Exploration is wholly owned by Chile Copper Co. which in turn is 99.756 percent owned by The Anaconda Company. The company mines, mills, smelts, and refines copper at Chuquicamata, Province of Antofagasta, Chile.

Capitalization:

\$1,000,000 in 10,000 shares of \$100 each; all shares are issued and fully paid, and held by Chile Copper Co.

Production:

1958, 234,599 tons; 1959, 306,497 tons; 1960, 254,778 tons.

Mine and plants:

The Chuquicamata mine is an open-pit operation and the largest copper mine in the world. The ore is oxide and sulfide. The oxide ore is leached for recovery of the copper as refined copper by electrowinning. The sulfide ore is concentrated and smelted, and the blister copper is electrolytically refined. Facilities include crushing plants, leaching vats, concentrator, tailing disposal system, dechloridizing plant, smelter, tank house for producing electrolytic copper by electrowinning and by electrodeposition, and melting plant for casting copper into marketable shapes.

Empresa Minera de Mantos Blancos.—Augustinas 1360, Casilla 153-D, Santiago, Chile.—A subsidiary of the Mauricio Hochschild organization, established in 1955 to develop the Mantos Blancos deposit 28 miles from the port of Antofagasta. The deposit consists of a series of ore bodies; five have been explored. The largest, Quinta Tercera, is being mined by open-pit methods. The ore is leached with sulfuric acid, and copper is precipitated with sulfur dioxide as cuprous chloride. The precipitate is mixed with lime and coke for reduction to copper, which is fire refined. Production began in December 1960 and by September 1961 capacity production of 1,650 tons of copper a month was achieved.

Empresa Nacional Mineria.—No. 1010, Fifth Floor, Union Central, Santiago, Chile.—This is the Government organization that controls operation of the copper smelter at Paipote on the outskirts of Copiapo in Northern Chile. Under Ministry of Finance Decree with Force of Law No. 153, February 29, 1960, the Empresa Nacional De Fundiciones (ENAF) and the Caja de Credito Y Fomento Minero (CACREMI) were joined to form the Empresa Nacional Mineria (National Mining Enterprise). By this decree the ore buying and concentrating operations of CACREMI and the copper smelting operations of ENAF have been combined in one organization as they were before the new copper law became effective in 1955 and gave autonomy to ENAF.

The smelter treats a mixture of copper ores and concentrates from medium and small producers in Chile, producing blister copper assaying 99.30 percent copper. The smelter has one reverberatory furnace, 110 by 30 feet, and three Pierce Smith converters—two 10 by 13 feet and one 10 by 20 feet—and handles about 160,000 to 170,000 tons of charge annually.

Cia Minera Disputada de las Condes.—Casilla 25 D, Santiago, Chile.—This company has taken over the copper mine and smelter formerly belonging to the Compagnie Miniere du M'Zaita. The smelter, 40 miles southwest of Santiago at Chagres, was reopened in 1960 after being inactive since 1945. Annual output is expected to reach 30,000 tons in 1962 and about

45,000 tons in 1965. The blister copper is shipped to the United States for refining.

Santiago Mining Co.—25 Broadway, New York 4.—A 96.673-percent-owned subsidiary of The Anaconda Company, this organization operates the La Africana mine and a 400-ton-per-day concentrator about 15 miles west of Santiago, Chile. Production began in September 1957, and the 1960 output was 21,023 tons of concentrate, averaging 28.1 percent copper.

Peru

Cerro de Pasco Corp., Incorporated in Delaware.—300 Park Ave., New York 22.—Incorporated in 1956 as Cerro de Pasco Corp. in Delaware; name was changed April 18, 1957.

Capitalization:

Authorized, 150,000 shares 6¼-percent-cumulative-convertible preferred stock, par value \$100 per share; all shares issued. 900,000 shares common stock, par value \$5 per share; 500,000 shares issued.

Wholly owned by Cerro Corp., this subsidiary operates copper-lead-zinc-silver mines and mills in the Departments of Pasco, Junin, and Lima, Peru, and smelting and refining works at La Oroya, Peru. The mines and mills are at Cerro de Pasco, Morococha, Casapalca, Yauricocha, and San Cristobál. Daily capacities of the selective flotation mills are Cerro de Pasco (Paragsha mill), 2,200 tons lead-zinc ore and 1,700 tons copper ore; Morococha, 1,000 tons copper, lead, zinc ore; Casapalca, 1,000 tons copper-lead-zinc and silver ores; San Cristobál (Mahr mill), 650 tons copper-lead-zinc ores. The copper smelter and refinery are at La Oroya; other facilities there include a lead smelter and refinery, an electrolytic zinc plant, a sulfuric acid plant, and several byproduct plants.

Compagnie Des Mines de Huaron.—Casilla Pastale No. 368, Lima, Peru.—Incorporated May 10, 1912, in Paris, France.

Capital:

Authorized, 360,000 shares of 25 new francs each; all shares issued and fully paid.

Operated lead-zinc-copper mines and mill at Huaron, Province of Cerro de Pasco, Peru.

Production, tons of concentrate:	1958	1959
Copper.....	14,678	16,353
Lead.....	13,885	12,789
Zinc.....	17,045	13,296

Northern Peru Mining Co.—120 Broadway, New York 5.—Wholly owned by American Smelting and Refining Company.

Operates the Quiruvilca mine and concentrator at Trujillo, Peru, which produces 5,000 to 6,000 tons of copper annually as concentrate. The concentrate is shipped to the American Smelting and Refining Company smelter at Tacoma, Wash.

Southern Peru Copper Corp.—120 Broadway, New York 5.—Incorporated December 12, 1952, in Delaware. The capital stock of Southern Peru Copper Corp. is owned 51½ percent by American Smelting and Refining Co., 22¼ percent by Cerro Corp., 16 percent by Phelps Dodge Corp., and 10¼ percent by Newmont Mining Corp.

Mine and plants:

Open-pit mine and concentrator at Toquepala and a smelter and powerplant at Ilo.

Production:

Operations at Toquepala began January 1, 1960, and scheduled production was achieved in March. Mine production of ore and waste averaged 166,897 tons per day in 1960. Ore milled averaged 26,052 tons per day,

containing 1.73 percent copper, which is substantially higher than the average of the ore body. 145,115 tons of blister copper was produced during the year.

EUROPE

Belgium

Societe Generale Metallurgique de Hoboken.—14, Rue Adolph Greiner, Hoboken near Antwerpen, Belgium.—Established in 1908, this concern is controlled by Union Minière du Haut Katanga.

Capitalization: Authorized, 550 million Belgian francs; all is issued.

Plants:

The plants are at Hoboken near Antwerp, Olen near Herentals, and Reppel near Bree.

Hoboken.—Plant comprises lead and copper smelters, copper converters, a lead refinery, a tin smelting and refining plant, a precious metals refinery, a selenium refinery, an antimony refinery, and a sulfuric acid plant.

Olen.—Electrolytic copper refinery and chemical products division, including: Cobalt refinery, metal, powder, oxides, and salts; radium plant; nuclear-grade uranium refinery, oxides, metal, and salts; germanium extraction and electronic-grade refining plant, dioxide, polycrystalline metal, intrinsic and doped single crystals; electronic-grade silicon plant; and nickel salts and sodium sulfate plants.

Reppel.—Producing arsenical products and insecticides.

Products and brands:

Electrolytic copper (UMK); HER Lead (Hoboken extra raffine); HER Lead (Star); tin (U.M.H.K.); S.G.M.H. antimony.

La Metallo-Chimique S.A.—8 rue d'Egmont, Brussels, Belgium.—Established in 1919.

Capitalization: Authorized, 35 million Belgian francs. Plant:

The plant at Beerse, Province of Antwerpen, consists of: (1) A pyrometallurgical plant—including water jacket, reverberatory, converter, and rotary furnaces with up-to-date filtering installations; (2) a chemical plant—including leaching, filtering, crystallizing, and precipitating facilities; and (3) an electrorefining copper plant.

Refined copper, copper ingots and alloys, copper sulfate, and other copper salts are produced from low-grade complex ores and concentrates, residues, ashes, slags, drosses, and copper-bearing scrap.

Bulgaria

Georgi Damyanov Copper Plant.—The first copper-producing plant in Bulgaria began operations at Pirdop in 1958 with an initial capacity of 8,000 metric tons of electrolytic copper annually. It was planned to increase the capacity to 25,000 tons in 1959. The plant was built by Soviet engineers, construction beginning in 1956. It uses Bulgarian ore and in addition to copper produces copper sulfate and sulfuric acid.

Czechoslovakia

Krompachy Copper Works (Slovakia).—This is a State copper-mining undertaking. Some difficulty has been experienced in smelting because of the high-arsenic content of the ores. In recent years an electrolytic copper refinery has been added.

Finland

Outokumpu Oy.—Töölönkatu 4, Kuparitalo, Helsinki, Finland.—Established in 1932.

Capitalization: Authorized, Fmk3,200 million; all is issued.

Plants:

Mines and concentrators at Outokumpu, Ylöjärvi, Vihanti, Kotalahti, and Aijala-Metsamonttu; a copper smelter at Harjavalta; and the electrolytic refinery and metal works at Pori.

The flash-smelting process is used at the Harjavalta smelter. All the copper produced is oxygen-free high-conductivity copper—brand HCOKOF. Annual refined copper capacity is 36,000 tons.

France

Compagnie Generale d'Electrolyse du Palais.—66 Avenue Marceau, Paris, France.—Established in 1950.

Capitalization: Authorized, Fr400 million; all is issued.

Plant:

The plant consists of a primary and a secondary copper smelter, an electrolytic copper refinery, electric-arc cathode-melting furnaces and gas-fired reverberatory furnaces for making fire-refined copper. The products are wirebars, billets, and slabs. Annual capacity is 33,000 tons. Nickel sulfate is a byproduct.

East Germany

Ilsenburg Copper Plant.—East Germany.—Electrolytic and refined copper are produced. Most of the rolling facilities are used for producing steel sheets. This concern is affiliated with VVB Vesta (Leipzig) which is the central planning authority for the iron and steel industry.

Huttenwerk Kayser.—This is now a publicly-owned concern, situated at Berlin in the Niederschöneweide section, and affiliated to VVB Alu, Potsdam in the Babelsberg section. It produces copper wirebars, brass, bronze, soft and hard lead, type metals, bearing metals, and remelted aluminum alloys.

Kombinat Wilhelm Pieck.—Formerly styled Mansfelder Kupferschieferbergbau, A. G., and subsequently Mansfelder Kupferbergbau und Huttenwerk, this is now a publicly-owned concern belonging to VVB Mansfeld (Eisleben).

This concern produces electrolytic and fire-refined copper, soft lead, red lead, zinc oxide for paints, zinc sulfate, selenium, cadmium, silver, gold, platinum, palladium, sulfuric acid, and vanadium salts, utilizing ores obtained from large-scale copper-mining operations in the Eisleben-Hettstedt area. The combine produces about 22,000 tons of copper a year from local ore, and this is expected to be increased to 31,000 tons by 1965.

West Germany

Duisburger Kupferhütte.—Werthausen Strasse 220, Duisburg, Germany.—Established in 1876.

Capitalization: Authorized, DM42,000,000.

Products:

The smelter and electrolytic and chemical plants at Duisburg produce copper cathodes and wirebars, lead, zinc, zinc oxide, cadmium, thallium, cobalt, gold, silver, and special pig iron and low-phosphoric-purple ore with 60 to 62 percent Fe. Byproducts include sodium sulfate, copper oxychloride, and thallium sulfate.

Kupferhütte Ertel, Bieber & Co.——Ballindam 11, Hamburg 1, Germany.—Established in 1881. The plant is in the free port area of Hamburg at Stillhornerdamm; it uses the Henderson process of chloridizing roasting in treating about 250,000 tons of cupreous pyrites annually.

The products are iron agglomerate, sinter, and purple ore having an annual capacity of 220,000 tons; copper, 3,300 tons; zinc oxide, 3,500 tons; lead, 1,000 tons; sodium sulfate, 12,000 tons; and minor quantities of gold and silver.

Metallhütte Kall, G.M.B.H.——Kall (Eifel), West Germany.—

Capitalization: Authorized and issued capital amounts to DM500,000.

Plant:

The plant is at Kall and consists of several converters for producing blister copper and other melting furnaces to produce copper alloy ingot from scrap metal.

Hüttenwerke Kayser Aktiengesellschaft.——Kupferstrasse, Lünen Nordrhein-Westfalen, West Germany.—Established in 1911.

Capitalization: DM4,200,000.

Plant:

A smelter at Lünen with copper blast furnaces and converters, an electrolytic plant with wirebar-casting facilities; and Mischzinn alloying-tin smelter.

Electrolytic copper production in 1958 was 31,600 tons. Raw materials used are scrap and residues.

Metallhüttenwerke Lübeck G.M.B.H.——24a Lübeck (Herrenwyk), West Germany.—Established in 1905.

Capitalization: Authorized, DM24,000,000; all is issued.

Plant:

The plant at Lübeck in Herrenwyk, a former section of Lübeck, consists of blast furnaces, coke ovens, refining furnaces, and an electrolytic copper refinery. In 1958 electrolytic copper production was 13,500 tons from copper-bearing pyrites, residues and blister, cement, and scrap copper.

Metallgesellschaft, A.G.——14, Reuterweg, Frankfurt (Main), West Germany.—Established in 1881.

Capitalization: Authorized, DM56,000,000; all is issued.

This concern mines and smelts ores and refines and fabricates metals. The company engages in trade, especially in ores, metals, and other products; banking and financing; and other commercial and industrial activities. These activities are carried on partly by departments and partly through subsidiaries. Affiliations with a number of enterprises are maintained through shareholding.

Norddeutsche Affinerie.——Alsterterrasse, 2, Hamburg 36, West Germany.—Established in 1886.

Capitalization: DM42,000,000; fully paid.

Plant:

The plant, at Hovestrasse 50, Hamburg, consists of copper and lead smelters, copper converters, a lead refinery, an electrolytic copper refinery, plants for recovering various metals, a precious metals refinery, a sulfuric acid plant, and plants for producing various chemicals. Annual capacity for electrolytic copper is 165,000 tons and for fire-refined copper is 33,000 tons; refined lead capacity is 40,000 tons.

Products:

Blister copper and electrolytic copper in all customary shapes and sizes, refined lead, antimony, arsenic, bismuth, selenium, gold, silver, platinum, palladium,

nickel, tin, antimonial lead, cobalt oxide, metal powders, metal salts, sulfuric acid, insecticides, and fungicides.

Zinnwerke Wilhelmsburg G.M.B.H.——Neuhofstrasse 26, Hamburg (Wilhelmsburg), West Germany.—Established in 1903.

Capitalization: DM3,000,000.

Plant:

An electrolytic copper plant having an annual refined copper capacity of 27,000 tons and a secondary smelter that processes scrap and residues.

Hungary

Csepel Iron & Steel Works.——This plant near Budapest has been producing copper as part of its activities and is now embarking on electrolytic refining. There is a rolling mill at the plant.

"Metallochemia" Works.——This concern produces fire-refined copper. Capacity is being expanded. The company also produces lead from domestic lead concentrates.

Italy

Societa Metallurgica Italiana.——99 Borgo Pinti, Florence, Italy.—

Plant:

Fire refining of copper; electrolytic copper refinery, having an annual capacity of 66,000 tons; high-frequency electric foundry for nickel and nickel alloys; Ajax-type electric foundry for brass and copper alloys; and semicontinuous four-high rolling equipment for manufacturing sheet and strip of copper and copper alloys, aluminum and aluminum alloys, and nickel and nickel alloys. The plants are at Fornaci di Barga, Provincia di Lucca; Campo Tizzoro, Provincia di Pistoia; and Limestre Provincia di Pistoia.

The raw materials used are fire refined, blister, cathode, and wirebar copper purchased on foreign markets. Copper and copper alloy scrap but not residues are purchased to be processed at the water-jacket furnace.

Montecatini Societa Generale per l'Industria Mineraria e chimica.——Via F. Turati 18/20, Milan, Italy.—Established in 1888.

Capitalization:

Authorized, Lit100 billion; all is issued.

Plants:

Alumina and blister copper plants are at Marghera, Provincia di Venezia. Copper is extracted from cupriferous pyrites cinders by chlorinating roasting, solubilization, cementation, and refining until reaching 98 to 99 percent blister copper. Aluminum reduction plants are at Bolzano and Mori, Provincia di Trento. There is also a selenium recovery plant at Vicenza; beryllium, boron, and lithium plants at Merano; and plants producing silicon, titanium, and zirconium at Novara. Annual capacity for blister-copper production is 6,600 tons.

Norway

Falconbridge Nikkelverk, Aktieselskap.——Kristiansand, Norway.—The metallurgical operations of Falconbridge Nickel Mines, Ltd., in Canada are limited to concentrating and blast furnace smelting. The matte produced is upgraded in basic-lined converters to about 80 percent copper plus nickel. This high-grade matte is shipped to Kristiansand, Norway, where it is processed in the company electrolytic refinery.

Orkla Grube-Aktiebolag.——Løkken Verk, Norway.—Incorporated October 1904 in Norway.

Capitalization:

NKr19,999,800 in 111,110 shares of NKr180 each; all issued and fully paid.

The smelting and refining subsidiary, Orkla Metal-Aktieselskap, is capitalized for NKr2,000,000, all held by the parent company.

Mines and plants:

Cupriferous iron pyrites mines are at Medalen, Norway. Ores are smelted and refined at Thamshamn in Orkedalsfjorden by Orkla Metal-Aktieselskap.

Production:

In 1959, 245,616 tons of ore was smelted, yielding 3,800 tons of copper and 78,349 tons of sulfur.

A/S Sulitjelma Gruber.—Fr. Nansens Plass 6, Oslo, Norway.—Established in 1891.

Capitalization: Authorized NKr5,500,000; all is issued.

Mine and plant:

The mine, concentrator, and smelter are at Sulitjelma about 60 miles east of Bodø. The concentrates are smelted in Westly electric furnaces and Bessemer converters. About 4,200 tons of blister copper was produced in 1958.

Poland

Legnickie Zakłady Metalurgiczne.—The first stage of this copper plant at Legnica was being constructed in mid-1954. Ore was to be supplied by a mine in the Bolesławiec region.

Zakłady Hutnicze Szopienice.—Located at Szopienice, Upper Silesia, this operation was formerly the biggest electrolytic zinc producer in Poland and belonged to Anaconda-Giesche. Estimated annual zinc capacity is 35,000 tons g.o.b. and 40,000 tons electrolytic. The plant also produces electrolytic copper and lead, with estimated annual capacities of 11,000 and 28,000 tons, respectively.

Spain

Electrolisis del Cobre, S.A.—Batista 3, Barcelona, Spain.—Established in 1941.

Capitalization: Authorized, Pts48,000,000; all is issued.

Mines and plants:

The company mines, the Concepcion and Ponderosa at Zalamea la Real, Huelva, have an annual output of about 110,000 tons of cupreous pyrites. The processing plants at Barcelona and Palencia have mechanical and flotation, ore-dressing installations; roasting furnaces and shaft furnaces; an electrolytic copper refinery; a copper sulfate plant; and a plant for recovering other metals in the ore. Annual capacities are as follows: Fire-refined copper, 16,500 tons; electrolytic copper, 11,000 tons; and brass, 550 tons.

Sociedad Espanola de Construcciones Electro-Mecanicas, S.A.—Calle de Alcala 16, 4° piso, Madrid, Spain.—Established in 1917.

Capitalization: Pts 302,596,500, fully paid.

The company refines copper and manufactures semi-fabricated copper, brass, and aluminum products. At Cordoba there are an electrolytic copper refinery, having an annual capacity of 35,000 tons; brass and light alloys foundries; hot and cold rolling mills; a rod mill, and a wire and cable mill. Items produced are electrolytic copper wirebars, ingot bars, slabs, cakes, and other refinery shapes, and brass mill and wire mill products such as sheet, strip, rod, wire, cable, profiles, tubes, coin blanks, and cups for making military cartridges. Aluminum and aluminum alloy are processed into sheet, strip, profiles, and other shapes. Annual production is about 45,000 tons.

There is a redraw mill at Bilbao that draws copper and brass wire from rod produced at the Cordoba plant.

Industrias Reunidas Minero-Metalurgicas, S.A.—Ibanez de Bilbao 2, Bilbao, Spain.—This concern

operates a smelter and refinery at Asua, Vizcaya. There are subsidiary plants at San Adrian de Besos, Barcelona, and Almuradiel, Ciudad Real. Installations include electrolytic refining equipment; water-jacket, reverberatory, and rotary furnaces and converters; and a sintering plant. Scrap materials and ores are used to produce copper refinery shapes, wirebars, ingots, etc.; brasses; bronzes; soft and hard lead; virgin tin, phosphor copper, 15 percent copper; and nonferrous metals and alloys.

Compania Espanola de Minas de Rio Tinto, S.A.—Alcala, 95,3°, Madrid, Spain.—This company was formed in 1954 to take over the entire assets of The Rio Tinto Co., Ltd., in Spain. The Rio Tinto Co. retains a third of the share capital in the new company and through subsidiaries provides certain technical and commercial services.

Capitalization: Authorized Pts 1 billion, in 666,667 A shares and 333,333 B shares, of Pts1,000 each.

Mines and plants:

The company massive pyrite mines in the Province of Huelva comprise about 32,000 acres. The processing plants near the mines include a flotation concentrator, a concentrate briquetting plant, a smelter with four blast furnaces, four Great Falls-type converters, and a small precipitate-smelting furnace. Blister copper is produced. Annual capacity is 7,700 tons; 1958 production was about 6,200 tons.

Sweden

Bolidens Gruvaktiebolag.—Sturegatan 22, Stockholm 0, Sweden.—Incorporated September 7, 1925, in Stockholm, Sweden.

Capitalization:

SKr100,800,000 in 1,008,000 shares of SKr100 each; all shares are issued and fully paid.

Mines and plants:

The company operates seven mines in the Norrland District and five in the Bergslagen District. The most important mines are the Laisvall, Kristineberg, Rudtjebacken, Ravliden, Renström, Boliden, Långsele, Garpenberg, and Vassbo. In addition, the company operates the publicly owned mines of Adakgruven. There are four concentrators in the Norrland area and three in the Bergslagen area. Most of the concentrates are treated in the copper and lead smelting plants at Rönnskär, near Skellefteå, where there is also an electrolytic copper refinery. Pyrite and zinc concentrates are exported.

Products:

White arsenic, annual capacity, 16,500 tons; electrolytic copper, annual capacity, 50,000 tons; refined lead, 45,000 tons; gold, silver, selenium, bismuth-lead alloy, pyrites, zinc concentrate, iron concentrate, lead concentrate, red lead, nickel sulfate, cesium salts, metallic arsenic, and sulfuric acid.

Reymersholms Gamla Industri Aktiebolag.—Hälsingborg, Sweden.—Capitalization: Authorized, SKr 30,000,000; issued SKr14,000,000.

Plants:

Located at Hälsingborg and Oskarshamn, the plants are copper extracting facilities, equipped with chloridizing, roasting, and smelting furnaces. Cupreous pyrites are treated by the wet process to produce cement copper which is refined in Sweden.

United Kingdom

Actid, Ltd.—High Blantyre, near Glasgow, Scotland.

Capitalization: Authorized, £10,000; all is issued.

Plant:

This is an electrolytic copper refinery at the Scottish Industrial Estate, High Blantyre. Refined copper is produced from scrap.

Thomas Bolton & Sons, Ltd.—Mersey Copper Works, Widnes, Lancaster, England.—Established in 1783.

Capitalization:

Authorized and issued, £500,000 in ordinary stock; £300,000 of 5 percent cumulative preferred stock, £600,000 in 4½ percent cumulative redeemable preferred stock.

Plants:

The company has two plants in Lancaster—Mersey Copper Works at Widnes, and Sutton Rolling Mills at St. Helens—and two in Stafford at Froghall and Oakmoor.

The Widnes works smelts and refines brass and copper residues and other copper-bearing scrap for the manufacture of Musey brand copper sulfate. It also refines blister copper and processes scrap.

The refinery of the Froghall works deals with electrolytic cathode copper and processes scrap from other works. High-conductivity copper is produced in all forms for manufacturing wire, strip, sheet, bars, rods, machined components, and similar products.

British Copper Refiners, Ltd.—Norfolk House, Norfolk St., London W.C. 2, England.—Established in 1932.

Capitalization: Authorized, 120,000 ordinary shares of £1 each, all are issued.

Plant:

The plant is at Prescott, Lancaster. Annual combined capacity for fire-refined and electrolytic copper is 100,000 tons—output of fire-refined in 1959 was 80,000 tons and of electrolytic was 7,000 tons. Other products include brass, bronze, and cadmium copper.

Elkington Copper Refiners, Ltd.—P.O. Box No. 24, Goscote Works, Walsall, Stafford, England.—Established in 1955, formerly Elkington and Company, Ltd.

Capitalization: Authorized, £600,000; all is issued.

Plant:

Copper fire-refining and electrolytic refining plant at Walsall, Stafford. Annual fire-refining capacity is 15,000 tons, electrolytic refining capacity, 10,000 tons.

Enfield Rolling Mills, Ltd.—Brimsdown, Enfield, Middlesex, England.—Established in 1924. Subsidiary companies are Enfield Copper Refining Company, Ltd.; Enfield Rolling Mills, Ltd., aluminum; London Zinc Mills, Ltd., The Aston Chain and Hook Company Ltd., and Barker and Allen, Ltd.

Capital: Authorized, £6,983,333; issued, £6,529,883.

Plant:

At Brimsdown, Enfield, Middlesex, the plant consists of a copper refinery, copper and brass sheet and strip mills, copper rod mill, and copper drawing mill. Copper and copper-base alloys produced are cast and fabricated into refinery and mill shapes.

McKechie Brothers, Ltd.—80 Hagley Road, Birmingham, England.—Established in 1894.

Capital: Authorized, £3,000,000; issued, £2,536,038.

Plants:

At Widnes, Lancaster, are copper smelting and refining, copper sulfate, copper powder, and lithopone plants. The company has copper and copper-base alloy fabricating plants at Aldridge, Stafford; Ratton Village, Birmingham; Stratford, London; Germiston, South Africa; New Plymouth, New Zealand; and Chatham, Ontario, Canada. Copper, copper-base alloys, and aluminum and aluminum alloys are cast in refinery shapes or fabricated into mill products.

Copper Pass and Son, Ltd.—Melton Works, North Ferriby, Yorkshire, England.—Established in 1830. Present company formed in 1912.

Capitalization: Authorized, £2,000,000; issued £1,735,630.

Plants:

The plants are at Bristol and North Ferriby, Yorkshire, and produce electrolytic copper, tin, lead, antimony, silver, tin-base alloys, antimonial lead, solder in all forms, and bismuth alloys from low-grade and complex ores and residues containing copper, lead, tin, antimony, bismuth, silver, and gold.

The Wolverhampton Metal Co., Ltd.—Well Lane, Wednesfield, Wolverhampton, Stafford, England.

Capitalization: Authorized, £1,000,000; issued, £591,000.

Plant:

The plant at Wednesfield has electric and reverberatory furnaces for producing high-grade, fire-refined copper and copper-base and aluminum-base alloys. The James Bridge Copper Works, Ltd., at Darlaston Road, Walsall, has smelting and electrolytic refining facilities and produces anodes, rough cakes and cathodes. Nickel-sulfate is produced as a byproduct.

U.S.S.R.

The U.S.S.R. is the fourth largest copper-producing country in the world, having an annual output of more than 500,000 tons which is approximately twice the quantity produced in 1950. Emphasizing prospecting and exploration and mine and plant expansions made known additional reserves and raised the output of copper ore and copper. The present seven year plan (1958-65) calls for an annual production of 1 million tons of copper by 1965.

The four principal copper areas in the U.S.S.R. are: Kazakhstan, the Urals, Uzbekistan, and Armenia. Other significant producing areas are the Kola Peninsula and Noril'sk. The principal copper smelters in the U.S.S.R. processing the ores from the mines in these regions are:

Smelter	Capacity, short tons
Karsakpay, Kazakhstan.....	220, 000
Balkhash, Kazakhstan.....	165, 000
Almalyk, Uzbekistan.....	165, 000
Pyshma, Ural.....	110, 000
Revda, Ural.....	55, 000
Blyava, Ural.....	55, 000
Minusinsk, Siberia.....	55, 000
Krasnoural'sk, Ural.....	44, 000
Karabash, Ural.....	33, 000
Kirovograd, Ural.....	28, 000
Allaverdy, Armenia.....	11, 000
Baymak, Ural.....	11, 000
Zangezur, Armenia.....	11, 000
Pechenga, Kola.....	6, 600
Kadjaran, Armenia.....	(1)
Monchegorsk, Kola.....	(1)
Total.....	969, 000

¹ No data.

Yugoslavia

Rudnici Bakra I Topionice Bor.—Bor, Yugoslavia.—The Government holds the majority interest in this concern, which was formerly Cie. Francaise des

Mines de Bor, a French-controlled company. The annual capacity of the smelting and refining plant at Bor was increased to 60,000 tons in 1960. Leaching, smelting, and electrolytic refining processes are used.

On June 25, 1961, the Majdanpek open-pit mine was officially placed in production, and the planned mining capacity rate, 12,000 tons of ore per day, was programed for 1962. Official statistics for production of blister and electrolytic copper are reported as follows:

Year:	Blister copper, short tons	Electrolytic copper, short tons
1939.....	45,903	13,738
1946.....	23,953	14,247
1956.....	32,390	27,655
1957.....	37,186	33,210
1958.....	37,117	32,964
1959.....	38,857	34,796
1960.....	39,384	38,639

Fabrika Kablova Svetozarevo.—Svetozarevo, Yugoslavia.—This is a wire and cable plant, equipped for producing oxygen-free, high-conductivity copper. The new refining unit was built by Ajax Engineering Corp., now Ajax Magnethermic Corp., Trenton, N.J., and began operating in 1955. Half the electrolytic copper production of Yugoslavia is converted to oxygen-free, high-conductivity copper and is vertically cast into wirebars at this plant.

ASIA

China

There are virtually no data available on the structure of the copper industry in China. Increasing estimates of production and other occasional news items indicate significant activity in mining, smelting, and refining, but specific information either on size, expansion, and production of established plants or construction of new concentrators, smelters, and refineries has not been found. The known plants are the Chunking copper refinery, Szechwan Province; Szechwan copper and zinc refinery, Tungchuan copper plant, Yunnan Province; and the Kunming electrolytic copper refinery, Yunnan Province. It is reported that a great number of small copper smelters, blast furnaces, were set up throughout China in 1958.

Cyprus

Cyprus Mines Corp.—For data on this company see Arizona.

Cyprus Sulphur and Copper Co., Ltd.—Limni, Polis, Cyprus.—Incorporated August 3, 1940, in Cyprus.

Capitalization:

£200,000, in shares of £1 each. 196,196 shares are issued and fully paid; 196,009 of the shares are held by Esperanza Copper and Sulphur Co., Ltd., a holding company.

Property:

The company holds lease on 30 square miles of the Limni concession in Cyprus, containing pyrites, copper, and gold. The Limni concentrator was rehabilitated in 1958. During the year ending March 3, 1960, 107,650 tons of cupreous pyrites, 1,990 tons of copper concentrates, and 467 tons of copper precipitates were produced during the year ending March 31, 1960.

India

Indian Copper Corp., Ltd.—Gillander House, Netaji, Subhas Road, Calcutta 1, India.—Registered London in 1924 as a reconstruction of Cordoba Copper Co., Ltd.

Capitalization:

Authorized, £2,000,000 in units of stock of 2s. each, issued, £1,371,300.

Production:

	1958	1959
Ore milled.....short tons	442,088	434,282
Refined copper.....do--	8,630	8,310

Mines and plants:

Mining operations consist of the Mosaboni and Badia copper mines and kyanite deposits at Kharsāwān. Power, concentrating, smelting, and refining plants; a rod mill; and a brass foundry have been erected at Moubhandar. An electrolytic copper plant under construction was scheduled for production by the end of 1962. Most of the copper produced is made into rolled brass products.

Israel

Israel Mining Industries.—Tel Aviv, Israel.—

This Government-owned company was designed and set up in 1951 to explore and develop mineral resources of Israel. One of the prime ventures of this company was development of the Timna ore deposit and associated processing facilities for leaching and precipitating copper by the cementation process.

Israel Mining has a capital of £1,000,000. The plant was designed to process 1,500 tons of ore daily or 500,000 tons a year. In 1959, 495,000 tons of ore was treated, yielding 4,930 tons of copper. The copper cement is shipped abroad for smelting and refining; however, the company plans are projected to produce blister or refined copper at Timna.

Japan

Dai Nippon Kogyo K.K.—Tokyo, Japan.—This company owns the Hassel smelter, which has eight stamping machines, one-Voleeze-type briquetting machine, two round Dwight-Lloyd sintering machines, one shaft furnace, and two converters. Annual capacity is about 6,000 tons; 5,900 tons was produced in 1958. Raw materials processed are concentrated fines, unconcentrated fines, unconcentrated lump, siliceous ore, and copper scrap.

The Dowa Mining Co., Ltd.—Tokyo, Japan.—Established in 1937, this company is capitalized for ¥3,045 million and is engaged in mining, smelting, chemical, and transportation industries. The company is noted for the copper, pyrite ore, and decopperized, pyrite cinder it produces. Other products are zinc-gypsum, sulfuric acid, gold, silver, lead, and copper sulfate.

Mines and plants:

	Location
Kosaka mine and smelter.	Kosaka, Kazuno-gun, Akita-ken.
Hanaoka mine.....	Hanaya-machi, Kitakita-gun, Akita-ken.
Yanahara mine.....	Yanahara, Kume-gun, Okayama-ken.
Akagane mine.....	Ezashika, Iwate-ken.
Nissho mine.....	Mamurogawa-machi, Mogami-gun, Yamagata-ken.
Okayama plant.....	3 Kaigan-dori 3 chome, Okayama.
Amagashi plant.....	5 Ogimachi, Amagasaki.

Production for the 6 months, from October 1958 to March 1959, was as follows:

Electrolytic copper.....short tons..	7,577
Cement copper, copper content....do....	539
Electrolytic zinc.....do.....	4,058
Electrolytic gold.....do.....	6,366
Electrolytic silver.....do.....	108,782
Electrolytic cadmium.....pounds..	17,637

The Furukawa Electric Co., Ltd.—No. 14, 2-chome, Marunouchi, Chiyoda-ku, Tokyo, Japan.—The company owns the following plants: Nikko Copper Works, Yokohama Cable Works, Osaka Copper Works, Kyushu Cable Works, and the Oyama plant.

The Nikko Copper Works produces electrolytic copper and refines byproduct gold and silver. It also produces copper and copper-alloy wire and fabricates copper and copper-alloy strip, sections, and forgings. In addition, it produces aluminum and aluminum-alloy wire sheet, strip, rods, pipe, sections, and forgings.

The annual electrolytic-copper refining capacity is 32,000 tons. Blister copper produced at the following mines is sent to this plant for refining. Ashio copper mine, owned by the Furukawa Mining Co., Ltd.; Osaruzawa copper mine, owned by Mitsubishi Metal Mining Co., Ltd.; and Tsubaki copper mine and Hasseia copper mine, owned by the Dai Nippon Mining Co., Ltd.

The Furukawa Mining Co., Ltd.—No. 8, Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan.—Formally established in 1918; originated in 1875. Capital: Authorized, ¥5,000,000,000; issued, ¥3,307,500,000.

Properties and plants:

This company has the following operating divisions: metal, electric power, machinery, chemical, and coal. The principal mines in the Metals Division are the Ashio, Nagamatsu, Ani, Kune, Iimori, and Daira. There are two plants in the Chemical Division, the Ashio smelter and the Osaka plant, producing sulfuric acid, cement copper, cupreous oxide, ferric oxide, and titanium dioxide. The Ashio smelter, built in 1956, uses the flash-smelting process developed by Outokumpu Oy in Finland.

Mitsubishi Metal Mining Co., Ltd.—No. 6, 1-chome Ohte-machi, Chiyoda-ku, Tokyo, Japan.—Established in 1950.

Capitalization: Authorized, ¥10,000,000,000; issued, ¥2,730,000,000.

Properties and plants:

This company mines, smelts, refines, and fabricates copper, lead, and zinc. The more important mines are the Shimokawa, Osarizawa, Washiamori, Hosokura, Akenobe, Ikuno, Myoho, and Makimine. The company also operates the Naoshima smelter and two refineries, the Akita and Osaka. Annual copper-smelting and electrolytic-refining capacities are 53,000 tons and 40,000 tons, respectively.

Mitsui Mining & Smelting Co., Ltd.—1,2-chome, Nihonbashi-Muromachi, Chuo-ku, Tokyo, Japan.

Capitalization:

Authorized, ¥9,600,000,000, 192,000,000 shares; issued, ¥4,800,000,000, 96,000,000 shares.

Mines and plants:

This company is one of the larger producers in Japan of refined zinc, copper, and lead and byproduct bismuth, cadmium, gold, silver, palladium, platinum, selenium, tellurium, and tin. It operates mines, smelters, and refineries and has the largest zinc-lead mine, Kamioka mine, and the largest zinc smelter, Miike smelter, in Japan. Blister copper is produced at the Hibi smelter and refined at the Takehara electrolytic refinery.

Copper production increased from 13,513 tons in 1958 to 25,438 in 1959.

Nihon Kogyo Kabushiki Kaisha, Nippon Mining Co., Ltd.—3, Akasaka Aoi-cho, Minato-ku, Tokyo, Japan.—Established in 1929.

Capitalization: Authorized and issued, ¥5,670,000,000.

Properties and plants:

The company owns 18 mines scattered throughout the country, smelters and refineries at Hitachi-shi and Saganoseki, and a smelter at Ogoya.

The Hitachi mine, smelter, and electrolytic refinery are at Miyatacho, Hitachi-shi, Ibaraki-ken. Mine production in 1958 was 5,500 tons of copper. The technique of autogeneous smelting in converters using oxygen-enriched air was introduced at this smelter near the end of 1958. The smelter is equipped with one blast furnace, four converters, and an oxygen plant. The smelter treats other domestic and imported ores and concentrates. Smelter capacity is 41,000 tons of product, and there is 48,000 tons of refining capacity for electrolytic copper with equal wirebar casting facilities. The refinery also has a gold and silver parting plant. There are two Lurgi-type contact sulfuric acid plants, having capacities of 150 and 220 tons per day, respectively, that use the sulfur dioxide in the converter gases.

The Saganoseki smelter and refinery are at Seki-machi, Saganoseki-machi, Kita-amabe-gun, Oita-ken. There is no mine at this plant site but the smelter operates on ores from other company mines, domestic custom ores, and imported material. The smelter has two blast furnaces and four converters. The refinery has a capacity of 43,000 tons of electrolytic copper a year, and there is a silver and gold parting plant.

There is also a lead smelting and refining plant, capacity 10,800 tons per year; a Lurgi-type contact sulfuric acid plant, having a capacity of 5,000 tons a month; and a ferronickel plant with three furnaces, having a capacity of 4,800 tons a year of nickel-content.

The Ogoya mine and smelter are at Ogoyamachi, Kamatsu-shi, Ishikawa-ken. Ore containing 2,650 tons of copper was mined and concentrated in 1958. The smelter has an annual capacity of 6,000 tons of blister copper that is sent to the Saganoseki electrolytic refinery.

Production and capacity:

	1968	Annual capacity, nominal
Electrolytic copper		
short tons..	40, 400	83, 200
Lead.....do....	6, 800	11, 100
Gold.....ounces..	76, 012	694, 500
Silver.....do....	1, 579, 790	6, 109, 000
Selenium.....pounds..	37, 383	47, 600

Sumitomo Metal Mining Co., Ltd.—No. 12, 5-chome Shimbashi, Shiba, Minato-ku, Tokyo, Japan.—Established in 1950.

Capitalization:

Authorized, ¥5,200,000,000; issued, ¥3,217,500,000.

Plants:

	Operations or products
Shisakajima smelter---	Copper and nickel smelting, sulfuric acid.
Niihama refinery.....	Copper, nickel, gold, and silver electrolysis.
Kunitomi smelter.....	Copper smelting and lead electrolysis.
Kohnomai cyanidation plant.....	Gold and silver cyanidation.

Antimony oxide, nickel sulfate, and copper sulfate also are produced.

North Korea

Virtually all of the metal producing works are in North Korea—north of the 38th parallel of latitude. Since this area is Communist-controlled, up-to-date information is lacking.

Republic of Korea

The only metal producer of any significance is the Changhung copper refinery, having an estimated capacity of 1,000 tons of copper a year.

Philippines

Atlas Consolidated Mining and Development Corp.—Soriano Building, Manila, Philippines.—Incorporated in the Philippines as Masbate Consolidated Mining Co. on March 1, 1935; name was changed in the 1953 merger with Antamok Goldfields Mining Co., Inc., and IXL Mining Co.

Capital:

₱25,000,000 in shares of ₱1 each; ₱17,240,481 shares, issued and fully paid.

Property:

The company owns the Toledo mine and a 15,000-ton-per-day concentrator on the island of Cebu, holds 35 percent of the capital of Phelps Dodge Copper Products Corp. of the Philippines, and a 40-percent interest in Atlas Fertilizer Corp. It operates an iron property of Philippine Iron Mines, Inc., for 10 percent of royalty, at Mati, Davao, on the Island of Mindanao. The iron ore is shipped to Japanese steel mills and the copper concentrate is sent to Mitsubishi Metal Mining Co. in Japan.

Production, short tons:	1958	1959
Ore.....	3, 487, 322	3, 931, 543
Copper.....	20, 755	21, 288

Lepanto Consolidated Mining Co.—Dinsco Bldg., 422 Arzobispo St., Manila, Philippines.—Incorporated in the Philippines September 21, 1936.

Capitalization:

₱20,000,000 in 200,000,000 shares of 10 centavos each; 138,633,334 shares are issued and fully paid.

Property:

The Lepanto mine and the 1,250-ton-per-day concentrator are at Mountain, Luzon, Philippines. The mine is the largest vein copper mine and the second largest producer in the country.

Production:	1958	1959
Copper.....short tons..	14, 439	15, 279
Gold.....ounces..	47, 230	49, 085
Silver.....do.....	196, 901	218, 094

Marinduque Iron Mines Agents, Inc.—Ledesma Bldg., Anda & Sta. Lucia St., Intramuros, Manila, Philippines.

Capitalization:

Authorized, ₱20,000,000 in 200,000,000 shares at 10 centavos per share.

Property:

The company owns two copper operations, the Bagaycay mine and mill on Samar Island and the Sipalay mine and mill in Negros Occidental Province. It also has a number of petroleum exploration concessions in various parts of the archipelago.

Production:

During the first 2 months of 1960, mine and mill operations at Bagaycay were adversely affected because of damage caused by Typhoon Gilda, which hit during December 1959. However, during 1960 the mine produced 4,275 tons of shipping-grade ore, averaging 12.33 percent copper and 150 tons of milling grade ore containing 3.19 percent copper and 2.19 percent zinc. Approximately 25,500 tons of concentrate, averaging 14.13 percent copper, 7.80 percent zinc, 0.023 ounce per ton gold, and 3.66 ounces per ton silver, was shipped in 1960.

The Sipalay operations were halted in April and May of 1960 by a labor strike. About 1,300,000 tons of ore was mined and milled to produce 33,200 tons of concentrate, containing 8,385 tons of copper.

The company obtained a \$13-million loan from the Export-Import Bank to finance purchase of equipment and machinery for an integrated copper-zinc smelting plant.

Philex Mining Corp.—Equitable Bank Bldg., Juan Luna St., Manila, Philippines.—Incorporated in the Philippines in 1955.

Capitalization:

Authorized, 90,000,000 shares at 10 centavos per share.

Property:

The company owns and operates the Santo Tomas II mine and mill in Paedal, Tuba, Mountain, Philippines. Mining is by open-pit and block-caving methods.

Production:

Of the 605,677 tons of ore mined and milled in 1960, 345,309 tons came from the open pit and 260,368 from underground; 14,106 tons of concentrate—containing 3,678 tons of copper, 12,532 ounces of gold, and 15,034 ounces of silver—was produced.

Turkey

Ergani Bakir Isletmesi Muessesesi, Ergani Copper Mining Co., Ltd.—Maden, Turkey.—Established in 1925. Owned, controlled, and operated by Eti Bank, a Government agency.

Capitalization:

Authorized, TL15,000,000 issued, TL10,000,000.

Mines and plants:

The company operations are at the town of Maden near Elazığ and Kiyarbakır in southeastern Turkey. There are two open-pit mines, a 450-ton-per-day mill, and a smelter equipped with two blast furnaces, four converters, and two refining furnaces.

Production in 1958:

	Short tons
Blister copper.....	16, 650
Fire-refined copper.....	3, 300

Murgul Bakir Isletmesi.—Damar, Hopa, Turkey.—There was some mining of the Damar deposit before 1916. The Government (Eti Bank) took over and began developing the property in 1938; production was resumed in 1951.

Capitalization: Authorized, TL20,000,000; all is issued.

Mine and plants:

This property consists of an open-pit mine, a 2,000-ton-per-day concentrator, and a smelter with one fire-refining furnace. A calculated annual production capacity of 10,000 tons of blister copper was based on the assumption of 3-percent copper ore—now estimated in the reserve at 2 percent copper. Production is about 7,500 tons of blister copper per year.

AFRICA

Republic of the Congo

Union Miniere du Haut Katanga.—Registered office: Elizabethville, Republic of the Congo; Administrative office: 6 rue Montagne du Parc; Brussels, Belgium.—Incorporated in 1906, in the former Belgian Congo; reincorporated in Belgium during 1960. The company was formed to acquire the interests of the Katanga (Belgian) Special Committee and Tanganyika Concessions, Ltd., in the mineral concessions made by the latter company, under a concession granted by the former (extending until March 11, 1960) and situated in Katanga Province. This concession com-

prises a copper area of about 7,700 square miles, containing also cobalt, zinc, uranium, radium, cadmium, germanium, silver, gold, iron ore and limestone deposits, and a tin area of about 5,400 square miles.

The company is one of the largest copper producers in the world and holds important interests in many

enterprises, one of the chief ones being Société Générale Metallurgique de Hoboken.

Capitalization:

Congolese francs 8,000,000,000 in 1,242,000 shares; all shares are issued.

Production:

	1957	1958	1959	1960
Copper.....short tons.....	264, 861	259, 686	309, 088	331, 466
Cobalt.....do.....	8, 945	7, 166	9, 293	9, 083
Zinc.....do.....	207, 431	220, 479	195, 965	211, 642
Germanium.....pounds.....	19, 987	35, 838	30, 077	57, 540
Cadmium.....do.....	258, 489	308, 364	217, 905	53, 792
Radium deliveries.....grams.....	89. 3	69. 8	101. 6	-----

Mines and plants:

The active mines are the Mine Prince Leopold (Kipushi), Musonoi, Kolwezi, Ruwe, Kamoto, Kambove, Lukuni, and Shinkolobwe.

Most of the ores are concentrated before smelting, and the company has concentrating plants at Kipushi and Kolwezi and a washing plant at Ruwe. Uranium ores are treated at the Shinkolobwe concentrator. Sulfide concentrates are sent to the Lubumbashi smelter which is equipped with four water-jacketed blast furnaces and two converters. The blister copper produced is refined at the Olen works of the Société Générale Metallurgique de Hoboken or in France at the copper refinery of Cia. Générale d' Electrolyse du Palais.

The oxide concentrates, which usually contain a little cobalt, are treated by leaching and electrolysis at the Jadotville-Shituru works. The company also owns an electric smelter at Jadotville-Panda, where certain ores are treated to produce cobaltiferous alloy and crude copper. The alloy is sent to Belgium for refining, and the crude copper is cast into anodes.

Northern Rhodesia

The modern history of the Copperbelt began in 1923 when the British South Africa Co. was granted exclusive prospecting rights over large areas of the Territory of Northern Rhodesia. The finding of copper ores containing from 3 to 5 percent copper in 1925 resulted in the development of mines at Luanshya (Roan Antelope), Kitwe (Nkana), Mufulira, and Chingola (Nchanga).

These mines and Chibuluma and Bancroft are controlled by two groups as follows:

Anglo American Corp. Group:

Bancroft Mines, Ltd.
Nchanga Consolidated Copper Mines, Ltd.
Rhokana Corporation, Ltd.
Rhodesia Copper Refineries, Ltd.

Rhodesian Selection Trust Group:

Chibuluma Mines, Ltd.
Mufulira Copper Mines, Ltd.
Roan Antelope Copper Mines, Ltd.
Ndola Copper Refineries, Ltd.

Anglo American Corporation of South Africa, Ltd.—44, Main Street, Box 4587, Johannesburg, Transvaal, Republic of South Africa.—Incorporated in the Republic of South Africa, September 25, 1917, the corporation was formed mainly as a finance and holding company, and to manage and perform technical and secretarial services for mining, investment, and industrial companies. The corporation has considerable interests in South Africa—mainly in gold, gold-uranium, diamond, and coal mines—and in the Federation of Rhodesia and Nyasaland, where its investments are principally in copper mines. Through affiliated companies it has substantial interests, direct and indirect, in many companies for whom it acts as secretary or technical advisor.

Capitalization:

£9,000,000 in £2,379,375 of 6 percent cumulative preferred stock, transferable in units of 10s., 1,241,250 6 percent preference shares of 10s. each, and 12,000,000 ordinary shares of 10s. each; £2,379,375 preferred stock and 10,587,002 ordinary shares were issued and fully paid December 31, 1960.

Bancroft Mines, Ltd.—70 Jameson Avenue Central, Salisbury, Southern Rhodesia.—Incorporated in Northern Rhodesia, May 21, 1953. The company holds special grants of mining rights over 63,000 acres and leasehold surface rights over 57,600 acres in the Bancroft area, Northern Rhodesia. Exclusive prospecting rights over the Kawiri area adjacent to the special grants are also held by the company.

Capitalization:

Authorized, £13,750,000 in 22,000,000 stock units of 5s. each, 3,000,000 ordinary shares of 5s. each, and 7,500,000 6½-percent redeemable participating preference shares at £1 each; all the stock units and preference shares are issued and fully paid.

Mine and plant:

The Kirila Bomwe South and Kondola ore bodies are being worked through two shafts, 1,500 and 1,400 feet deep, respectively. The Kirila North ore body is being explored north of the No. 1 shaft on the 1,150 level by a third shaft. The concentrator has the capacity for treating 170,000 tons of ore per month. The concentrate is sent to the Rhokana smelter at Nkana.

Production:

For the year ended June 30, 1960, 1,655,700 tons was milled for 58,424 short tons of recoverable copper-in-concentrate; blister copper production was 57,256 tons.

Nchanga Consolidated Copper Mines, Ltd.—70 Jameson Avenue Central, Salisbury, C. 4, Southern Rhodesia.—Registered in London March 8, 1937; management and control transferred to Northern Rhodesia, January 1, 1951. Reincorporated in Northern Rhodesia May 11, 1954, under Rhoanglo Group Act, 1953.

The Company holds special grants of mining rights over 36,100 acres and leasehold surface rights over 29,800 acres in the Chingola area, Northern Rhodesia. It also holds mining rights covering 564 acres and prospecting rights covering 2,200 acres in the King Edward mine area west of Lusaka, Northern Rhodesia.

The Company participated with Rhokana Corp., Ltd., in forming Rhodesia Copper Refineries, Ltd., and in acquiring the 500,000 shares of ordinary stock issued.

Capitalization:

£28,000,000 in stock units of £1 each, all issued and fully paid.

Mines and plant:

The copper ore is obtained by underground mining of the Nchanga West ore body and by open-pit mining of the Nchanga and Chingola ore bodies. The concen-

trating and leaching plants have a combined capacity for treating 360,000 tons of ore per month.

The sulfide copper concentrates are sent to the Rhokana Corp. smelter at Nkana. The oxide concentrates are treated in the leach plant, and copper cathodes produced by electrowinning are sent to the Rhodesia Copper Refineries plant at Nkana for melting and casting into finished shapes.

Production:	Ore milled	Copper content of concentrates
1957-58-----short tons--	3,544,500	148,861
1958-59-----do-----	3,648,500	162,596
1959-60-----do-----	4,357,100	207,336

Rhokana Corporation, Ltd.—70 Jameson Avenue Central, Salisbury, C. 4, Southern Rhodesia.—Registered in London February 16, 1923, as Rhodesian Congo Border Concessions, Ltd.; name changed March 1931; control transferred to Northern Rhodesia as of January 1, 1951; reincorporated May 11, 1954, in Northern Rhodesia under the Rhoanglo Group Act, 1953.

The Corporation holds mineral rights covering 52 square miles in the Nkana area and 54 square miles in the Bwana Mkubwa area near Ndola. The freehold and leasehold surface rights in the Nkana and Bwana Mkubwa areas total approximately 100 square miles.

Capitalization:

Authorized, £26,500,342 in 24,950,342 ordinary shares of £1 each, 50,000 A shares of £1 each, and 1,500,000 of 5½-percent redeemable cumulative preference shares of £1 each. Issued, 24,950,342 ordinary stock units of £1 each, 49,678 A stock units of £1 each, and 767,955 of 5½-percent redeemable cumulative preference shares of £1 each, including a bonus issue of 9 shares for every ordinary and A share held from 1959 to 1960.

Principal shareholdings:

Company:	Percent of shares issued
Rhodesia Copper Refineries, Ltd.-----	50.0
Bancroft Mines, Ltd.-----	43.38
Nchanga Consolidated Copper Mines, Ltd.-----	33.6
Mufulira Copper Mines, Ltd.-----	26.56
Chibuluma Mines, Ltd.-----	26.68
Chambishi Mines, Ltd.-----	26.68
Chisangwa Mines, Ltd.-----	30.0
Rhodesia Congo Bondu Power Corp., Ltd.-----	25.0
Baluba Mines, Ltd.-----	26.68

Mines and plants:

The mines and surface plants are at Nkana, Northern Rhodesia. Ore production is from the Nkana North and Mindola sections and the Nkana South ore body. A concentrator and smelter treat about 16,000 tons of ore per day. There is a sulfuric acid plant, an electrolytic-copper refinery, and an electrolytic-cobalt refinery. A recovery plant for treating uranium-bearing ore from the Mindola section operated from May 1957 to July 1959.

The ores are concentrated to produce sulfide copper concentrate and cobalt concentrate. The former is smelted with copper concentrates from Nchanga and Bancroft. The copper produced is cast as blister cakes for market or anodes for electrolytic refining in the adjacent plant of Rhodesia Copper Refiners, Ltd. The cobalt concentrate is roasted and leached with sulfuric acid, and the cobalt is recovered by electrowinning from the sulfate solution.

Production:

	1958	1959	1960
Blister copper, short tons--	28,172	29,264	30,374
Electrolytic copper short tons--	67,390	56,956	86,084
Electrolytic cobalt short tons--	1,269	1,092	1,307

Rhodesia Copper Refineries, Ltd.—70 Jameson Avenue Central, Salisbury, C. 4, Southern Rhodesia.—Registered in London, January 1, 1947; head office transferred to Nkana, Northern Rhodesia, January 1, 1951; reincorporated in Northern Rhodesia May 11, 1954, under the Rhoanglo Group Act, 1953; head office moved to Salisbury, Southern Rhodesia, August 5, 1957.

Capitalization:

Authorized, 500,000 shares of £1 each; 1,300,000 shares of 5-percent redeemable cumulative preference shares of £1 each; 700,000 shares of £1 each. Issued, 500,000 ordinary shares converted into stock units of £1 each and 1,024,127 of 5-percent redeemable cumulative preference shares converted into stock units of £1 each. The ordinary stock is held equally by Rhokana Corporation, Ltd., and Nchanga Consolidated Copper Mines, Ltd. The preference stock is quoted on the London and Rhodesian Stock Exchange.

Operations:

The company operates an electrolytic copper refinery adjacent to the Rhokana Corp. smelter at Nkana. The plant is equipped with facilities for casting horizontal and vertical wirebars and shapes.

Rhodesian Selection Trust, Ltd.—Livingston House, 48 Jameson Central Avenue, Salisbury, C. 4, Southern Rhodesia.—Registered in London May 22, 1928; control transferred to Northern Rhodesia July 1, 1953; reincorporated in Northern Rhodesia July 1, 1954, under the Rhodesian Selection Trust, Ltd., and Associated Companies Act, 1954.

This concern is a holding company 50.60 percent controlled by American Metal Climax, Inc. Its principal asset is the 64.67-percent ownership of Mufulira Copper Mines, Ltd. In addition, a 64.98-percent interest is held in Chibuluma Mines, Ltd.; Baluba Mines, Ltd.; and Chambishi Mines, Ltd., as well as a controlling interest in Rhodesian Selection Trust Exploration, Ltd. A wholly owned subsidiary, Rhodesian Selection Trust Investments, Ltd., was formed in 1957 and acquired certain investments from the company.

Capitalization:

£12,000,000 in 48,000,000 shares of 5s. each; 45,239,116 shares are issued and fully paid.

Chibuluma Mines, Ltd.—48 Jameson Avenue Central, Salisbury, C. 4, Southern Rhodesia.—Incorporated July 2, 1951, in Northern Rhodesia, the company acquired from Mufulira Copper Mines, Ltd., a special mining grant covering the Nkana South Limb area seven miles west of Kitwe and about 34 miles southwest of the Mufulira mine.

Capitalization:

Authorized and issued £1,000,000 in £1 shares; Rhodesian Selection Trust, Ltd., holds 64.29 percent.

Of the cost of equipping and developing the property, £5,000,000 was loaned by the General Services Administration of the U.S. Government under an agreement providing for repayment in copper and cobalt. As of June 30, 1961, the balance was £406,488 which was repaid in the following fiscal year.

Mine and plant:

The mine started hoisting ore in October 1955, and the mill, having a capacity of 40,000 tons per month, began full operation in April 1956. The main ore body

is mined by the cut-and-fill method, and the deepest haulage level is 945 feet below the surface. The ore body west of the mine is being developed through the Norrie shaft, which was sunk to a vertical depth of 1,185 feet. This new development is expected to increase annual production 4,500 tons beginning in 1963. The copper concentrates are sent to the Mufulira smelter. The mixed copper/cobalt concentrate is roasted and smelted at the cobalt treatment plant managed by Ndola Refineries, Ltd.

Production: Year:	Copper, short tons	Cobalt, sales, thousand pounds
1957-----	16, 233	-----
1958-----	30, 443	-----
1959-----	21, 544	1, 660
1960-----	24, 700	1, 600

Mufulira Copper Mines, Ltd.—48 Jameson Avenue Central, Salisbury, C. 4, Southern Rhodesia.—Registered in London February 3, 1930. Control transferred to Northern Rhodesia as from July 1, 1953; reincorporated in Northern Rhodesia July 1, 1954, under Rhodesian Selection Trust, Ltd. and Associated Companies Act, 1954. The company has special grants of mining rights covering a total area of 76,816 acres in the Luangwa District of Northern Rhodesia.

Mufulira is 64.67 percent controlled by Rhodesian Selection Trust, Ltd., which in turn is 50.60 percent controlled by American Metal Climax, Inc.

Capitalization:

Authorized, 18,000,000 shares of £1 each; issued, 15,866,622 shares of £1 each, fully paid.

Mine and plants:

The Mufulira mine is equipped with a concentrator-smelter, and electrolytic refinery. The annual production capacity will be increased approximately 50 percent to about 170,000 tons when development of the western area of the mine is completed and plant extensions installed.

Production:	Ore mined	Blister copper produced
1958-----short tons--	4, 352, 832	104, 153
1959-----do-----	4, 123, 493	98, 623
1960-----do-----	4, 894, 015	116, 154

Roan Antelope Copper Mines, Ltd.—48 Jameson Avenue Central, Salisbury, C. 4, Southern Rhodesia.—Registered in London June 3, 1927. Control transferred to Northern Rhodesia as from July 1, 1953; reincorporated in Northern Rhodesia July 1, 1954, under Rhodesian Selection Trust, Ltd., and Associated Companies Act, 1954. The company holds three special grants of mining rights for the entire 10,803 acres located 24 miles southwest of Ndola.

Capitalization:

Authorized, £18,000,000 in ordinary units of stock and shares of 5s. each. Issued, £16,177,838 15s. 0d. in 64,711,355 shares and units of stock of 5s. each, fully paid.

Mine and plants:

The property is equipped with a concentrator and smelter to produce copper at a rate of about 100,000 tons per year. Production is refined at the plant of Ndola Copper Refineries, Ltd.

Production:	Tons mined	Blister copper production
1958-- short tons--	5, 707, 900	89, 523
1959-- do-----	5, 549, 800	90, 644
1960-- do-----	6, 661, 800	102, 028

Ndola Copper Refineries, Ltd.—48 Jameson Avenue Central, Salisbury, C. 4, Southern Rhodesia.—Incorporated March 30, 1954, in Northern Rhodesia.

The company operates an electrolytic-copper refinery at Ndola, Northern Rhodesia, and supervises and operates the cobalt plant of Chibuluma Mines, Ltd., at Ndola.

Capitalization:

Authorized, 4,500,000 shares of £1 each. Issued, 4,500,000 shares of £1 each, fully paid.

Roan Antelope Copper Mines, Ltd., holds two-thirds of the capital and British Insulated Callenders' Cables, Ltd., one-third.

Operations:

The first stage of the tankhouse and refined-copper-casting operations started up in the latter part of 1958 with an initial annual electrolytic-copper capacity of 60,000 tons. An extension to the refinery is under construction which will increase its production to 110,000 tons per year.

Republic of South Africa

Messina (Transvaal) Development Co., Ltd. (M.T.D.)—Messina, Northern Transvaal, Republic of South Africa.—Incorporated January 27, 1950, in the Republic of South Africa. The company was formed to acquire a company of the same name registered in London January 30, 1905. The mining property in Northern Transvaal consists of an area of 17,990 morgen (37,779 acres) in the Zoutpansberg District. The company also has the Umkondo claims, the Alaska copper property, and the Alaska smelter in Southern Rhodesia; it owns approximately 62 percent of the issued capital of M.T.D. Mangula, Ltd. Other subsidiaries are M.T.D. (Sanyati), Ltd.; M.T.D. Copper (Sales), Ltd.; The Messina (Rhodesia) Development Co., Ltd.; and Messina Rhodesia Smelting & Refining Co., Ltd.

Capitalization:

Authorized, £2,500,000; £2,462,500 in 9,850,000 stock units of 5s. each is issued; 150,000 shares are unissued.

Operations:

At Messina, Transvaal, the working plant consists of five producing shafts; a crushing, sorting, milling, and concentrating plant; and a smelter with reverberatory, converter, and refining furnaces. Fire-refined copper, averaging 99.91 percent and conforming to British Standard 1037 is produced.

A smelting and refining plant was erected near Alaska, 13 miles west of Sinoia, Southern Rhodesia to handle concentrates from the Mangula and Alaska mines. The plant will be operated by Messina Rhodesia Smelting & Refining Co., Ltd., whose capital of £750,000 is 80-percent held by Messina (Transvaal) Development Co., Ltd., and 20-percent held by M.T.D. (Mangula), Ltd. Production at the Alaska smelter began in December 1960.

Production:

During the year ending September 30, 1960, the Messina and Umkondo concentrating plants handled 1,136,761 tons of ore for 40,820 tons of concentrates; the smelter produced 15,389 tons of copper. Production from the Mangula and Alaska mines for the same period amounted to 1,141,300 tons of ore, yielding 25,923 tons of concentrates containing about 13,250 tons of copper.

O'okiep Copper Co., Ltd.—Nababiep, Cape Province, Republic of South Africa.—Incorporated in the Republic of South Africa in May 1937. Ore was found at the site of the present mines by Governor van der Stet in 1686, but there were no actual mining operations until 1852. The Cape Copper Mining Co., Ltd., mined in the area from 1863 to 1888, when it was succeeded by the Cape Copper Co., Ltd. Most of the production came from the Nababiep South, the old O'okiep, the Spektakel, and the Narrap mines.

The company has mineral holdings covering approximately 256,106 acres and a half share in mineral rights over an additional 52,093 acres at O'okiep, Namaqualand. In addition, 90,000 acres consisting of 32 base mineral claims are owned outright, and optional rights are held on 38 base metal claims and on mineral rights of 13 farms. The principal mines are the Nababiep, East O'okiep-Narrap, Wheal Julia, and Nababiep West.

Capitalization:

Authorized, £1,600,000 in 3,200,000 shares of 10s. each; 1,021,056 shares are issued and fully paid, Newmont Mining Corp. holds 56.3 percent.

Mines and plants:

The Nababiep, O'okiep, Wheal Julia, and Nababiep West are underground mines; the Carolusberg West is an open-pit mine. There are concentrators at Nababiep and O'okiep, and a smelter, a 40-ton-per-day sulfuric acid plant and three leaching plants at Nababiep. A new mill, having a capacity of 100,000 tons per month, will be erected at Carolusberg for production anticipated in 1963.

Production:

In the year ended June 30, 1960, 1,775,600 short tons of ore was milled. The smelter treated 132,724 tons of concentrate and produced 39,457 tons of blister copper.

Tsumeb Corporation, Ltd.—Tsumeb, South-West Africa.—Incorporated January 4, 1947, in South-West Africa. This company was formed by Newmont Mining Corp.; American Metal Co., Ltd., now American Metal Climax, Inc.; O'okiep Copper Co., Ltd.; and four British and South African companies to purchase all the assets, except cash, debts, and investments, of Otavi Minen und Eisenbahn Gesellschaft (Otavi Mines and Railway Co.) from the Custodian of Enemy Property in the former Union of South Africa for

£1,010,000. The properties comprise 1,788 hectares of mining rights and almost 60,000 acres of grazing and horticultural land in the Grootfontein District, South-West Africa.

The Tsumeb copper-lead-zinc mine was operated by a German-controlled company from 1908 to 1940. It had been developed to a depth of 1,900 feet.

Capitalization:

Authorized, SA £1,050,000 in 4,200,000 shares of 5s. each; 4,000,000 shares are issued and fully paid. Stock ownership is as follows:

Company:	Percent of stock held
American Metal Climax, Inc.	28.5
Newmont Mining Corp.	28.5
Selection Trust, Ltd.	14.25
O'okiep Copper Co., Ltd.	9.50
South West Africa Co., Ltd.	2.37
Union Corp., Ltd., and others	16.88

Mines and plants:

The De Wet shaft was sunk to a depth of 3,301 feet and ore hoisting through the shaft began early in 1955; this shaft will be deepened to 4,150 feet.

The first 300-ton unit of a 2,000-ton flotation mill began operating in March 1948, and a pilot plant for producing germanium-enriched concentrate was placed in operation in 1954. A copper smelter is being constructed at Tsumeb which will have an annual output capacity of 20,000 tons of blister copper. A lead smelter and refinery with an annual capacity of 80,000 to 90,000 tons of refined lead will be built beside the copper smelter and is scheduled for operation by mid-1963.

Production:

The following shows the refined metals accounted for by smelters:

	1956	1957	1958	1959
Copper.....short tons	25,767	27,792	28,939	28,991
Lead.....do	90,206	87,436	72,539	79,623
Zinc.....do	4,177	13,172	22,636	21,609
Cadmium.....pounds	122,935	403,203	675,831	349,724
Silver.....ounces	1,404,812	1,701,536	1,708,027	1,701,934
Tons ore milled.....short tons	624,857	638,481	666,062	625,534

OCEANIA

Australia

Mount Isa Mines, Ltd.—363 Adelaide St., Brisbane, Queensland, Australia.—Incorporated in Queensland December 11, 1931, to acquire operations of company of the same name registered January 15, 1924, in New South Wales. Controlling interest of 53.8 percent is held by American Smelting and Refining Co. Wholly owned subsidiaries are Copper Refineries Pty., Ltd., Stuart, Townsville, Queensland, and Britannia Lead Company, Ltd., Northfleet, Kent, England. Products are blister and refined copper, refined lead, lead alloys, refined silver, and zinc concentrate.

Capitalization:

Authorized, A£10,000,000; issued, A£9,524,565 in 38,098,261 shares of 5s. each.

Mines and plants:

The Mt. Isa mine is the largest copper producer in Australia. Mill capacity is 8,100 tons of combined sulfide ore daily, and the smelter has been enlarged to a capacity of 70,000 tons of blister copper a year. Capacity of the Townsville electrolytic plant of Copper Refineries Pty., Ltd., is 80,000 tons annually.

Production:

For the year ending June 30, 1960, Mt. Isa Mines, Ltd., produced 3 million tons of ore from which were extracted 45,332 short tons of blister copper; 97,040 tons of copper concentrate, containing 24,063 tons of copper, for treatment overseas; 56,582 tons of lead bullion, containing 4,282,970 ounces of silver; and 37,698 tons of zinc concentrate, containing 19,604 tons of zinc. Copper Refineries Pty., Ltd., produced 31,185 tons of refined copper from Mount Isa blister.

Mount Morgan, Ltd.—11 Castlereagh St., Sydney, Australia.—Incorporated July 18, 1929, in New South Wales. The company acquired the Queensland assets of Mount Morgan Gold Mining Co., Ltd., July 1, 1929; the assets included freehold property, mining leases, and plant and equipment at Mount Morgan and a coal mine at Baralaba.

Capitalization: Authorized A£2,444,876; issued, A£2,081,625.

Mine and plant:

The company has an open-pit mine operated with electric shovels and diesel trucks, two flotation plants with combined capacity of 6,000 tons of sulfide ore daily, and a smelter. The smelter is equipped with roasters, a reverberatory furnace fired with pulverized

coal, and a converter. Blister copper is shipped to Port Kembla, New South Wales, for refining and sale.

Production:	1959	1960
Copper-----short tons--	7,857	8,112
Gold-----ounces--	67,085	69,020
Silver-----do-----	20,285	25,195

Peko Mines N.L.—82 Elizabeth St., G.P.O. Box 3351, Sydney, New South Wales, Australia.—Incorporated in New South Wales, Australia, in 1950.

Capitalization: Authorized, A£2,000,000; issued A£787,500.

Mine and plant:

The mine is a copper-gold property at Tennant Creek, Northern Territory. A shaft has been sunk to a depth of 1,130 feet and a 400-ton-per-day mill is in operation. The concentrate is transported by road and rail to Port Augusta, South Australia, for shipment abroad.

Production:

For the year ending June 28, 1960, 139,000 tons of ore was milled, yielding 28,606 tons of concentrate containing 7,509 tons copper, 12,720 ounces gold, and 42,909 ounces silver.

The Electrolytic Refining and Smelting Co. of Australia Proprietary, Ltd.—360 Collins St., Melbourne, Australia.—The company plant at Port Kembla, New South Wales, treats various copper, silver, and gold bearing materials—including blister copper, cathode copper, and copper scrap. The plant consists of a smelter, casting department, and refinery department. The smelter is equipped with a blast furnace and converters. Anodes, wirebars, ingot bars, cakes, and

billets are cast in the casting department. The refinery has an electrolytic tankhouse, a silver mill for recovery of silver, gold, and platinum-group metals, a selenium plant, and a copper sulfate plant.

Tasmania

Mount Lyell Mining and Railway Co., Ltd.—381 Little Collins St., Melbourne, Australia.—Incorporated in Melbourne, Australia, August 11, 1903, to take over a company of the same name and the North Mount Lyell Copper Co., Ltd., owning copper mining leases and reduction works at Mount Lyell, about 18 miles from Macquarie Harbour on the West Coast of Tasmania. The property now covers 4,864 acres. The company holds large interests in fertilizer and chemical industries, in Metal Manufacturers, Ltd., manufacturers of copper wire, sheets, tubes, cables, etc., with works at Port Kembla, near Sydney, and in Renison, Ltd., (Tasmania).

Capital: Authorized, A£5,000,000; issued and fully paid, A£4,059,777.

Mine and plant:

Except for some underground exploration ore in the Crown Lyell No. 2 mine, the entire output is mined from the West Lyell open pit. The reduction works consist of a flotation mill, smelter with blast furnace and converters, and a sintering plant. The blister copper is refined at the company electrolytic refinery at Queens-town, which has an annual capacity of 13,000 tons of refined copper.

Production:	1959	1960
Cathode copper---short tons--	10,094	11,260
Silver-----ounces--	31,369	38,372
Gold-----do-----	6,125	6,994

CHAPTER 8.—EMPLOYMENT AND PRODUCTIVITY

EMPLOYMENT

The working force of the copper industry engaged in mining and beneficiating ores, smelting concentrates, and refining copper has remained relatively steady since World War II, averaging approximately 33,000 men annually and ranging from a low of 29,000 in 1946 to a high of 37,000 in 1956. The average number of men employed daily in 1960 was 32,900. About half were engaged in mining, one-sixth in milling, and a third in smelting and refining. This distribution has been fairly uniform throughout the postwar years with increases and decreases of employment in all operations following the accelerated or relaxed industrial activity of the country.

The years of highest employment at copper mines were 1916 and 1917; slightly more than 61,000 men mined a little more than 1 million tons of recoverable copper in 1916 and just under 1 million tons in 1917. In 1929 it took 37,000 men to mine 1 million tons; in 1942 and 1943, 23,500; in 1956 and 1957, 18,000; and in 1960, 15,600. This decrease in employment is due to adoption of mass mining and milling methods which require fewer production workers.

Widespread mechanization and large-scale operations have changed the number of men and the types of skills needed. Men now are trained for specific tasks and less dependence is placed on the mining skills of the workers. Mining is directed and supervised by experienced foremen in accordance with plans prepared by technically trained mine superintendents and engineers. Mechanization has increased the demand for mechanics, engineers, technicians, and operators of many kinds of machines, eliminating a large number of unskilled laborers. A resultant rise in productivity is due to the greater portion of copper ore mined by the open-pit method (table 81), plus technological advances in the mining processes and equipment.

Safety

In table 81 employment and injury statistics are given by underground and open-pit mining methods. The notable reductions in injuries and their frequency are due largely to the increasing proportion of workers being exposed

to less hazardous conditions in open-pit mines. Also, substantial progress has been made in preventing accidents at surface and underground mines through technologic advances, proper education, discipline, good management, and intelligent administration.

Employment Statistics

The statistics of mine employment from different sources vary according to method of reporting. The Bureau of Mines reports the average number of men working daily at mines, at concentrators, and at smelters and refineries (combined). The Bureau of Labor Statistics shows monthly payroll figures and averages these figures annually for total employment at mines and concentrators. The Bureau of the Census reports the average mid-month employment in March, May, August, and November of the census years. Statistics from all these sources are shown in the following tables. However, Bureau of Mines data are used in evaluating productivity changes because of the separate and more complete coverage of mines, mills, and smelters and refineries.

PRODUCTIVITY

Definitions of the term "productivity" tend to vary according to the purpose for which the term is used. Usually productivity is considered to be the relation of output to input, but one concept refers to it as the relation of input to output. Input consists of capital equipment, raw materials, and labor-time; output consists of goods and services produced.

Productivity is expressed, frequently, in units of output per man-hour of labor, reflecting the ratio of output to a specific measure of input. In some instances it is advantageous to show the inverse ratio. Thus, productivity can be measured in tons of ore produced per man-hour or in man-hours required to produce a ton of ore. The second concept is used as a measure of production efficiency and also shows the labor cost per unit of output. For example, both concepts were used in comparing the efficiencies of block caving and other underground methods of mining at Butte, Mont. (table 82).

Productivity, however, results from a composite of many input factors. Although most productivity measurements appear as units of

TABLE 81.—*Employee and injury data at underground and open-pit mines*

Year	Employees		Injuries		Frequency rate, per million man-hours	
	Under-ground	Open pit	Under-ground	Open pit	Under-ground	Open pit
1939.....	15,268	3,168	2,307	212	67.39	26.95
1940.....	16,351	3,147	2,447	176	60.84	20.82
1941.....	16,466	5,110	2,812	211	69.01	14.67
1942.....	17,615	5,607	2,752	233	62.27	17.48
1943.....	18,652	5,048	3,322	254	71.36	17.97
1944.....	14,459	4,367	2,381	209	66.79	17.64
1945.....	10,355	4,187	1,393	161	56.54	14.86
1946.....	8,911	4,058	1,344	136	65.51	16.78
1947.....	10,723	4,931	1,506	181	59.18	14.12
1948.....	10,935	5,345	1,344	259	51.03	19.40
1949.....	10,645	5,382	1,016	187	45.95	14.82
1950.....	9,870	5,513	1,012	181	44.74	12.29
1951.....	10,282	5,992	1,024	299	42.94	18.89
1952.....	8,712	6,198	911	280	44.25	16.78
1953.....	8,983	6,911	961	276	45.16	15.16
1954.....	9,447	6,628	920	227	44.93	14.49
1955.....	9,711	7,289	1,116	292	64.90	15.88
1956.....	10,822	7,325	1,269	222	55.50	11.03
1957.....	10,603	7,061	1,120	175	57.18	16.79
1958.....	8,397	6,575	788	143	55.11	10.12
1959.....	7,744	6,457	625	105	52.11	8.20
1960.....	7,387	8,261	683	127	54.13	5.40

output per man-hour, which is labor productivity, such measures indicate the effect of some change or series of changes that cannot be attributed solely to labor. The input factors also include planning, engineering, research, and managerial competence. Some or all the factors are affected by geography, weather, size and grade of deposit, and by local, national, and international political and economic changes.

TABLE 82.—*Comparison of mine efficiency by block caving with other mining methods in Butte district.*

	1952	1953	1954	¹ 1955
Labor output, average:				
Tons of ore per man-shift:				
Block caving.....	9.37	15.20	15.65	16.24
Other methods.....	2.36	2.58	2.43	2.65
Labor requirement, average:				
Man-hours per ton of ore:				
Block caving.....	.86	.53	.51	.49
Other methods.....	3.39	3.10	3.29	3.02

¹ First 6 months.

Production efficiency may be expressed as labor measurement in comparing productivity differences due to factors unrelated to labor input. For instance, a spokesman for The Anaconda Company referred to the increasing importance of open-pit and block-caving meth-

ods of mining in their Montana operations, stating that in the first six months of 1959 open-pit mining accounted for 63 percent of total production; block-caving, 27 percent; and stope mining, 10 percent. In emphasizing the advantage of the open-pit and block-caving methods of mining, production was expressed in tons per man-shift, as follows: Stope mines accounted for an average of 3.4 tons per man-shift; block-caving, 26.3 tons per man-shift; and open-pit operations, 86.9 tons per man-shift. The productivity reference here is to the mining method, with all input factors considered, not just labor.

Besides measuring productivity in terms of labor input, it can, of course, be expressed in terms of any one element of input or in terms of all elements of input. Thus, it could be measured by production per dollar of capital investment, production per unit of energy consumed, or production per unit of raw material consumed. But, because 40 to 60 percent or more of the total cost of most productive operations is labor cost, expressing productivity in units of labor shows this measurement in terms of the major element of input. Such expression does not mean that workers create or are the sole cause of production because the importance of other elements of input are well recognized.

Mine Productivity

Over the last fifty years the annual recoverable copper content of copper ores produced in the United States has almost doubled; the bulk of ore mined has increased almost fivefold. In 1911 it required 110 million man-hours to produce 30 million tons of ore containing 557,000 tons of copper; whereas in 1960, 35 million man-hours produced 135 million tons of ore yielding 1.08 million tons of copper. Converting this information into productivity terms, 0.27 ton of ore and 10.1 pounds of metal were produced per man-hour in 1911, compared with 3.88 tons of ore and 62.0 pounds of copper per man-hour in 1960 (table 83). These increases in production and productivity, and the decreases in the number of men and man-hours required are due principally to the greater use of large-scale

mining methods—open-pit and block-caving—and the high degree of mechanization of most all operations.

From 1939 to 1960 the quantity of ore mined per man-hour increased 196 percent while the recoverable copper rose only 79 percent. Also in the same period, the cost of wages per ton of ore increased 32 percent, while that for recovering 1 pound of copper-in-concentrate rose 115 percent. The explanation for this anomaly is that while large scale mining methods have helped to keep down labor costs in ore production, the average recoverable metal content of ore has been decreasing steadily since 1939, causing the average wage cost per ton of metal to accelerate more rapidly than per ton of ore. Cost elements contributing to the increasing labor cost per ton of ore and per pound of metal are higher wage rates and more fringe benefits.

TABLE 83.—U.S. copper mine productivity—wages and labor cost, 1911–60

Year	Mined copper, recoverable content, thousand pounds	Man-hours worked, thousand	Output per man-hour in pounds, copper	Recoverable copper in ore, percent	Total ore mined, thousand tons	Ore per man-hour, tons	Average wage per man-hour	Average wage per pound metal	Average wage per ton ore
1911	1,114,762	110,195	10.1	1.82	29,998	0.27			
1912	1,249,092	126,650	9.9	1.71	35,656	.28			
1913	1,235,570	138,954	8.9	1.67	36,337	.26			
1914	1,148,416	102,760	11.2	1.60	35,176	.34			
1915	1,488,074	113,691	13.1	1.66	43,404	.38			
1916	2,005,878	151,457	13.2	1.70	57,963	.38			
1917	1,895,434	152,885	12.4	1.80	58,483	.38			
1918	1,910,024	152,833	12.5	1.51	62,289	.41			
1919	1,212,330	94,852	12.8	1.65	36,122	.38			
1920	1,224,552	89,457	13.7	1.63	36,765	.41			
1921	466,194	35,690	13.1	1.70	13,396	.37			
1922	964,596	60,040	16.1	1.74	26,893	.45			
1923	1,477,740	82,452	17.9	1.58	45,519	.55			
1924	1,606,164	81,121	19.8	1.59	49,178	.61			
1925	1,678,118	83,366	20.1	1.54	53,103	.64			
1926	1,725,274	84,096	20.5	1.46	57,182	.68			
1927	1,649,950	77,023	21.4	1.41	56,725	.74			
1928	1,809,784	79,205	22.8	1.41	62,097	.78			
1929	1,995,104	95,870	20.8	1.41	68,298	.71			
1930	1,410,144	66,002	21.4	1.43	47,752	.72			
1931	1,057,750	41,019	25.8	1.50	33,989	.83			
1932	476,222	18,605	25.6	1.53	12,261	.66			
1933	381,296	13,472	28.3	2.11	8,348	.62			
1934	473,896	14,727	32.2	1.92	11,659	.79			
1935	760,982	22,293	34.1	1.89	19,009	.85			
1936	1,229,032	34,900	35.2	1.54	38,505	1.10			
1937	1,683,966	51,982	32.4	1.29	61,501	1.23			
1938	1,115,525	34,600	32.2	1.34	37,962	1.09			
1939	1,456,640	42,098	34.6	1.25	55,221	1.31	\$0.68	\$0.020	\$0.518
1940	1,756,172	48,700	36.1	1.20	69,278	1.42	.73	.020	.512
1941	1,916,296	55,100	34.8	1.15	78,453	1.42	.79	.023	.558
1942	2,160,122	60,400	35.8	1.09	92,286	1.53	.90	.025	.591
1943	2,181,636	60,689	35.9	1.04	98,120	1.67	1.01	.027	.603
1944	1,945,098	47,496	40.2	.99	91,064	1.92	1.02	.026	.533
1945	1,545,788	35,474	43.6	.93	77,473	2.18	1.04	.029	.479
1946	1,217,474	28,622	42.5	.91	62,232	2.17	1.16	.027	.533
1947	1,695,126	38,264	44.3	.90	87,865	2.30	1.32	.030	.575
1948	1,669,626	39,684	42.1	.92	84,729	2.14	1.46	.035	.680
1949	1,505,500	34,730	43.3	.91	76,033	2.20	1.51	.035	.687
1950	1,818,686	37,345	48.7	.89	94,586	2.53	1.60	.033	.633
1951	1,856,660	39,677	46.8	.90	95,494	2.41	1.70	.036	.704
1952	1,850,718	37,280	49.6	.85	99,947	2.68	1.88	.038	.701
1953	1,852,896	39,488	46.9	.85	101,065	2.56	2.00	.043	.781
1954	1,670,944	36,143	46.2	.83	93,654	2.59	2.05	.044	.792
1955	1,997,140	40,500	49.3	.83	112,550	2.78	2.17	.044	.781
1956	2,208,312	45,961	48.0	.78	131,776	2.87	2.30	.048	.801
1957	2,173,718	41,452	52.4	.77	129,716	3.13	2.39	.046	.764
1958	1,958,658	31,295	62.6	.79	114,824	3.67	2.42	.039	.659
1959	1,649,992	26,382	62.5	.74	103,716	3.93	2.51	.042	.639
1960	2,160,338	34,824	62.0	.73	134,994	3.88	2.65	.043	.683

Source: Output: United States Bureau of Mines. Man-hours worked: 1911–36—WPA—"Copper Mining" 1940; 1936–60—Bureau of

Mines. Hourly wages: Bureau of Labor Statistics, Bulletin Copper Mining (102), and Monthly Labor Reviews.

The average wage per man-hour for copper mining has almost quadrupled since 1939. In addition, the effective wage rate has been increased by fringe benefits, some such as paid vacations, holiday pay allowances and premiums, sick leave, compensation for unemployment, industrial injury, and occupational disease are entirely paid for by the companies. Other common advantages provided by employers, in which employees share some of the cost, are Social Security, hospital-medical-surgical plans covering employees and dependents, and life insurance. The cost of fringe benefits can amount to 20 percent or more of the average straight time wage rate.

The largest increases in production and productivity rates have occurred in open-pit mines. Because these mines have contributed most of domestic production, 80 percent in 1960, they tend to lift the productivity average of the whole industry.

Concentrator Productivity

Productivity in ore concentration plants may be measured by man-hours of labor per ton of ore milled. Employment, production, productivity, and labor-cost data covering the period from 1943 to 1960 inclusive are shown in table 84.

Most of the ore-dressing processes are mechanical and plants usually require a fixed number of men for various operations; as a consequence the productivity and labor-cost per ton varies with the tonnage treated. However, significant portions of the increased efficiencies at the new and enlarged concentrators

are due to technological advances made in new equipment and automation, accounting for the treatment of greater tonnages with less men.

Smelters and Refineries

Data are not readily available on productivity at smelters and refineries, principally because the number of workers and man-hours are not reported separately for smelters and refineries.

However, some idea of the productivity and productivity changes at these plants may be had from tables 85 and 86.

The man-hours worked at smelters and refineries are matched with smelter output from domestic ores to derive a productivity expression of pounds of copper per man-hour. Refined production from domestic ores is very close to the smelter output, being only 142,413 tons (0.7 percent) less for the 21-year period from 1939 through 1960.

Although the number of employees and man-hours are relatively steady so that the changes in indicated productivity appear to be caused by varying production quantities, considerable credit must be given to the following improvements in smelting and refining processes and equipment:

1. Elimination of roasting at some smelters.
2. Larger reverberatory furnaces.
3. Gas-deoxidation of converter copper.
4. Improved casting equipment at smelters for anodes and at refineries for wirebars, cakes, and billets.
5. Continuous casting at refineries.

TABLE 84.—*Productivity data of copper concentrators in the United States 1943-60*

Year	Employment		Production		Productivity		Labor cost	
	Average men working daily	Man-hours worked, thousands	Tons of ore milled, thousands	Recoverable copper content, thousand pounds	Tons ore milled per man-hour	Pounds of recoverable copper per man-hour	Man-hour per ton of ore milled	Man-hour per pound recoverable copper
1943.....	7, 095	19, 797	92, 247	1, 794, 992	4. 66	90. 67	0. 215	0. 01102
1944.....	6, 558	18, 104	86, 393	1, 628, 392	4. 77	89. 95	. 210	. 01111
1945.....	5, 891	15, 439	73, 959	1, 327, 538	4. 79	85. 99	. 209	. 01162
1946.....	5, 579	12, 436	58, 521	1, 030, 280	4. 71	82. 85	. 212	. 01207
1947.....	5, 846	15, 100	83, 283	1, 454, 598	5. 52	96. 33	. 181	. 01038
1948.....	6, 308	15, 998	80, 098	1, 420, 094	5. 01	88. 77	. 200	. 01126
1949.....	6, 582	15, 526	72, 019	1, 287, 342	4. 64	82. 92	. 216	. 01206
1950.....	5, 828	15, 731	90, 206	1, 583, 886	5. 73	100. 69	. 175	. 00993
1951.....	6, 033	16, 205	91, 021	1, 590, 528	5. 62	98. 15	. 178	. 01018
1952.....	6, 141	16, 969	95, 307	1, 571, 652	5. 62	92. 62	. 178	. 01079
1953.....	6, 243	17, 254	96, 595	1, 587, 658	5. 60	92. 02	. 179	. 01086
1954.....	7, 096	16, 699	89, 620	1, 421, 714	5. 37	85. 14	. 186	. 01174
1955.....	6, 222	15, 854	108, 061	1, 745, 040	6. 82	110. 07	. 147	. 00908
1956.....	6, 683	18, 400	127, 251	1, 915, 828	6. 92	104. 12	. 145	. 00960
1957.....	7, 083	18, 095	124, 640	1, 899, 106	6. 89	104. 95	. 145	. 00952
1958.....	6, 468	14, 618	114, 028	1, 758, 916	7. 80	120. 33	. 128	. 00831
1959.....	5, 588	11, 156	103, 239	1, 496, 508	9. 25	134. 14	. 108	. 00745
1960.....	5, 230	13, 129	134, 306	1, 926, 408	10. 23	146. 73	. 098	. 00681

TABLE 85.—*Productivity data of smelters and refineries, combined*¹

Year	Average men working daily	Man-hours worked, thousands	Smelter production of copper, thousand pounds	Pounds copper per man-hour
1939	9,234	21,643	1,424,350	65.8
1940	10,743	25,092	1,818,168	72.5
1941	10,927	27,848	1,932,144	69.4
1942	10,286	27,911	2,175,982	78.0
1943	10,153	28,533	2,185,878	76.6
1944	7,728	21,733	2,006,758	92.3
1945	10,420	28,947	1,565,452	54.1
1946	10,187	23,573	1,199,312	50.9
1947	12,393	31,938	1,725,744	54.0
1948	12,419	32,496	1,684,954	51.9
1949	11,626	28,395	1,515,862	53.4
1950	11,756	30,402	1,822,704	60.0
1951	11,928	31,198	1,861,548	59.7
1952	10,629	27,508	1,854,730	67.4
1953	11,177	28,943	1,886,782	65.2
1954	11,244	27,316	1,668,762	61.1
1955	11,691	29,661	2,014,622	67.9
1956	12,194	31,497	2,235,160	71.0
1957	11,826	30,583	2,162,110	70.7
1958	10,801	26,966	1,985,836	73.6
1959	11,204	23,516	1,598,658	68.0
1960	12,009	29,445	2,285,696	77.6

¹ Approximate: Employment for smelters and refineries not separable, and some refinery man-hours chargeable to refined production derived from foreign ores.

TABLE 86.—*Copper industry employment data*

Year	Mining		Ore-dressing		Smelting-refining		Total	
	Employment ¹	Man-hours worked, thousands	Employment ¹	Man-hours worked, thousands	Employment ¹	Man-hours worked, thousands	Employment ¹	Man-hours worked, thousands
1943	23,700	60,689	7,095	19,797	10,153	28,533	40,948	109,019
1944	18,826	47,496	6,558	18,104	7,728	21,733	41,268	87,333
1945	14,542	35,474	5,891	15,439	10,420	28,947	30,853	79,860
1946	12,969	29,622	5,579	12,436	10,187	23,573	28,735	64,631
1947	15,654	38,264	5,846	15,100	12,393	31,938	33,893	85,302
1948	16,280	39,684	6,309	15,998	12,419	32,496	35,007	88,178
1949	16,027	34,730	6,582	15,626	11,626	28,395	34,235	78,651
1950	15,383	37,345	5,828	15,731	11,756	30,402	32,967	83,478
1951	16,274	39,677	6,033	16,205	11,928	31,198	34,235	87,080
1952	14,910	37,280	6,141	16,969	10,629	27,508	31,680	81,757
1953	15,894	39,488	6,243	17,254	11,177	28,943	33,314	85,685
1954	16,075	36,143	7,096	16,699	11,244	27,316	34,415	80,158
1955	17,000	40,500	6,222	15,854	11,691	29,661	34,913	89,015
1956	18,147	45,981	6,683	18,400	12,194	31,497	37,024	95,678
1957	17,664	41,452	7,083	18,095	11,826	30,583	36,573	90,130
1958	14,972	31,295	6,468	14,618	10,801	26,966	32,241	72,879
1959	14,201	26,382	5,588	11,156	11,204	23,516	30,993	61,054
1960	15,648	34,824	5,230	13,129	12,009	29,445	32,887	77,328

¹ Average number men working daily.

BIBLIOGRAPHY

- American Management Association. Meeting the Productivity Challenge. AMA Management Rept. No. 40, New York, 102 pp.
- The Brookings Institution. Productivity, Wages, and National Income. Pamph. No. 23, Washington, D.C., 1940, 21 pp.
- Bureau of Labor Statistics. Employment, Hours, and Earnings in Copper Mining. Bull. 102, September 1950.
- Bureau of Labor Statistics. Monthly Labor Review.
- Irving, Donald R., and Arthur Berger. Technologic Trends in the Mineral Industries. (Metals and Nonmetals Except Fuels). BuMines, 1959 Min. Yearbook, 1960, pp. 57-86.
- Kuzell, Charles R., and W. J. Uren. Labor-Management Relations in the Mineral Industries of North America. Ch. 14 in Economics of The Min. Ind., AIME, New York, 1959, pp. 607-654.
- Leong, Y. S., Emil Erdreich, J. C. Burritt, O. E. Kiessling, C. E. Nighman, and George C. Heikes. Technology, Employment, and Output Per Man in Copper Mining. Works Progress Admin., Nat. Res. Proj., Washington, D.C., 1940, 260 pp.
- Popoff, C. C. Block Caving at Kelley Mine, The Anaconda Company, Butte, Mont. BuMines Inf. Circ. 7758, September 1956, 102 pp.
- Tyler, Paul M. Cost of Acquiring and Operating Mineral Properties. Ch. 5, Econ. of The Min. Ind., AIME, New York, 1959, pp. 163-237.
- Tyler, Paul M. From the Ground Up. McGraw-Hill Book Co., New York, 1948, 248 pp.

CHAPTER 9.—RESEARCH AND DEVELOPMENT

Research and development departments have long been an integral part of many copper producing and fabricating firms. Some companies that do not have their own or adequate scientific facilities and personnel contract their research projects to outside organizations, such as commercial laboratories, engineering service firms, research institutes, and colleges and universities. Many of the copper and copper-base-alloy fabricating companies have erected new facilities or expanded their existing scientific laboratories to study properties and methods of manufacturing copper and copper-alloy products for traditional as well as new fields of use. The emphasis given science and technology by the industry, the Federal Government, educational institutions, and other organizations, points up the value of basic and applied research in development of future growth for the copper industry. Studies in solid-state physics will be emphasized in the coming years to obtain fundamental knowledge and to discover new scientific facts pertaining to the metals industry. Continuing applied research will be directed toward improving the technology of recovery and processing of copper, recovering byproduct metals, and developing new applications.

INDUSTRY RESEARCH

The knowledge gained through numerous studies of science and techniques has resulted in the development of improved equipment, processes, and products, as well as more effective planning and management to meet the worldwide growing demand for copper. The advantages realized by the major copper producers from efforts expended in research have encouraged them to emphasize their research activities for the future. A brief résumé of some of the research and development programs through 1961 follow.

U.S. COMPANIES

The Anaconda Company

The Anaconda Company has made large investments in new research facilities in recent years. Geological research laboratories at Butte, Mont., and El Salvador, Chile, contribute to the basic knowledge of ore formation and a variety of different problems. Mining engineers are continuously investigating mining

methods, techniques, and equipment to find means of mining and handling lower grade ore economically, and new underground mining methods to extract high-grade ore from the deep mines. A new company unit, the Extractive Metallurgical Research Division, established in 1962 at Anaconda, Mont., undertakes projects for the various operations. This division may also contract for projects to be completed by other research organizations in the Western Hemisphere. The Anaconda Wire and Cable Company, a subsidiary, inaugurated an extra-high-voltage research laboratory at Hastings-on-the-Hudson, N.Y., in 1959 and has other research centers at Marion, Ind., and Muskegon, Mich. The Anaconda American Brass Company, another subsidiary, dedicated a new Research and Technical Center at Waterbury, Conn., in 1961 for studies in basic and applied research.

American Smelting and Refining Company

At the American Smelting and Refining Company, Central Research Laboratories, South Plainfield, N.J., research is being done in the detection, determination, and control of impurities in both high-purity elements and commercial metals. A continuing study of the basic chemistry of electrolytic refining of copper has yielded knowledge that permits refining of anodes much higher in silver and certain other impurities than was thought possible a few years ago. This research department developed equipment for the semicontinuous casting of cakes and large billets. At New Haven, Conn., the company works on problems of surface cleaning, treating, and finishing of metals.

American Metal Climax, Inc.

American Metal Climax, Inc., conducts research and development activities concerning its copper, lead, and zinc operations through Amco Research & Development, Inc., a wholly owned subsidiary located at Carteret, N.J. The research program includes investigations of a wide range of nonferrous alloys, improvement of plant operations to increase the value of raw materials processed and byproducts recovered, and pilot plant studies for modernizing copper refining and casting.

Cerro Corp.

Cerro Corp. explores for new ore deposits, carries on metallurgical and process research, and participates in programs for new product development. Studies by the research department of Cerro de Pasco Corp. in Peru include: Economic recovery of metals from zinc plant leach residue, improved recovery of copper from mine waters, leaching-in-place of low grade copper ores, and smelting high-grade lead concentrates without sintering.

Copper Range Company

The Copper Range Company has research facilities at the White Pine Copper Company, a wholly owned subsidiary at White Pine, Mich. These are equipped for investigation and improvement of recovery processes. The laboratories of nearby Michigan College of Mining and Technology are used for additional studies of recovery techniques through pilot plant stages. Recovery has been increased to 85 percent at White Pine from the original 82 or 83 percent, and a continuing research program is being emphasized for greater efficiency. Each 1 percent of additional recovery means production of an additional 1 million pounds of copper annually. Copper Range maintains modern facilities at Alloyd Electronics Corp. in Cambridge, Mass., for metallurgical research and testing of the company products. The research equipment here includes that needed for investigation of properties of metals and for experimentation in development of new products. Specialized work is conducted in electron beam techniques, vapor deposition, heat treating, and protective coatings.

Inspiration Consolidated Copper Co.

The Inspiration Consolidated Copper Co. revised its concentrator treatment in 1961, as a result of process research, and produced a copper concentrate averaging 35 percent copper, compared with the 23-percent concentrate of 1960. The amount of waste material treated by the smelter was reduced about 40 percent, and the improved concentrate could be smelted easier and quicker.

Kennecott Copper Corp.

Kennecott Copper Corp. research and development activities are carried on at the Western Research Center in Salt Lake City, Utah; the laboratories of Chase Brass & Copper Co. in Waterbury, Conn.; and the laboratories of Okonite Co. in Passaic and Paterson, N.J. The Western Research Center laboratories

contain modern scientific equipment and pilot plants designed for investigating mining, milling, smelting, and refining operations. Studies here resulted in development of the leach-precipitation-flotation process for concentrating the mixed oxide-sulfide ores of the Ray Division of the company, recovery of byproduct rhenium, development of an electrolyte-purification system, and new reclamation techniques for re-use of water at the various concentrating mills. Research at the Chase and Okonite laboratories is planned for improvement of fabricated products, development of new products, and discovery of new uses for copper and copper base alloys. Research achievements at Chase include new alloys, improved coatings for copper and brass, continuous casting of copper, improved methods of joining copper, and methods of processing columbium, titanium, zircaloy, and rhenium. In Salt Lake City and Denver, Bear Creek Mining Co., the exploration subsidiary of the corporation, is undertaking comprehensive chemical and mineralogical studies at its own and the Kennecott laboratories to develop new geochemical prospecting techniques for use in exploration. Kennecott is presently building a basic research laboratory at Lexington, Mass.

Newmont Mining Corp.

Newmont Mining Corp., through the geophysical department of Newmont Exploration, Ltd., at Danbury, Conn., has developed two novel devices for geophysical surveying. One is an electromagnetic drill-hole apparatus and the other an improved overvoltage or induced polarization device used in electromagnetic field surveys. The Newmont metallurgical department participated in developing a slag-fuming process for recovering germanium from slag at the Tsumeb Corporation, Ltd., operation in Southwest Africa.

Phelps Dodge Corp.

Phelps Dodge Corp. conducts research at all its divisions and fabricating plants to improve operating processes and to develop better and new products. A new process developed at the Douglas, Ariz., smelter removes oxygen from blister copper with reformed natural gas instead of wood poles. A method of manufacturing sponge iron from iron oxides produced in the smelting process was also developed at Douglas. The sponge iron is expected to provide a more economical precipitant for copper in leaching operations. Different processes for recovering the small amount of copper present in the ore in oxide form at Morenci are constantly being investigated. At the fabricating plants, the

metallurgical laboratory at Bayway, N.J., perfected a new cupronickel alloy having high strength and corrosion-resisting properties and the ability to resist high temperatures. In the condenser-tube field important developments were the perfection of a welding process joining tubes to condenser sheets and a condenser tube with a tapered-end design to prolong the life of the tube by increasing its resistance to water turbulence. A new laboratory for research in pipe, tube, and other extrusion products began operation in 1961. At the Habirshaw Cable and Wire Division, Yonkers, N.Y., laboratory-developed products included a self-supporting, aerial-telephone cable with built-in messenger wire; a helical-membrane, air-dielectric coaxial cable; improved power cables for use in underground mines; and a combined conduit and cable assembly that can be installed in a single operation.

FOREIGN COMPANIES

The ever increasing interest in research implied by the efforts of the above companies is manifested also by similar research activities of copper producers and fabricators in foreign countries.

FEDERAL BUREAU OF MINES

The research program of the Bureau of Mines related to copper is concerned principally with extraction and beneficiation of ores. Some projects in basic research have been initiated for a better understanding of the problems associated with mining and metallurgical procedures.

Two areas of research related to mining are essential parts of the Bureau program. These are (1) Development of engineering principles and mathematical techniques applicable to exploration, development, and operational problems in mining, and (2) study of rock mechanics and geologic structure affecting ground control. The first area includes three categories: Methods research of ore sampling, mine-systems analysis, and statistical evaluation of mineral exploration problems. The second area involves studies in two main categories: Laboratory investigations of how rock behaves under loads imposed by mining operations and field examinations to evaluate stress-strength relationships in full scale operating mines.

Mining research is conducted at five Bureau locations—Denver, Colo.; Minneapolis, Minn.; Reno, Nev.; Spokane, Wash.; and College Park, Md. Each unit is assigned a special field of investigation and has laboratory space and equipment for its particular research activity. The Denver Mining Research Center

engages in rock mechanics research with respect to ground control and development of engineering principles and mathematical techniques applicable to exploration, development, and operational problems of mining. At the Minneapolis Mining Research Center research involves rock penetration, fragmentation, and supporting operational problems. The Reno Office of Mining Research specializes in studies of open-pit slope design. The Spokane Office of Mining Research has primary responsibility for research on artificial ground stabilization, and the Applied Physics Research Laboratory at College Park investigates applications of physics to all phases of mining.

The Bureau metallurgical research program respecting copper involves studies in mineral dressing, hydrometallurgy, and pyrometallurgy—emphasizing investigations of fundamental actions and reactions in concentrating and leaching ores, smelting concentrate, and recovering byproducts. Each project is directed toward improving the efficiency of a process by solving problems and analyzing procedures, or it is aimed at discovering new knowledge about why certain basic chemical or metallurgical reactions follow the same pattern under similar or all conditions.

The Bureau of Mines metallurgical research units include seven centers and five associated laboratories. The centers are at Albany, Oreg., and Reno, Nev., with associated laboratories at Boulder, Nev., and Berkeley, Calif.; Salt Lake City, Utah, with a laboratory at Tucson, Ariz.; Rolla, Mo., and Minneapolis, Minn., with a laboratory at Bruceton, Pa.; College Park, Md., with a laboratory at Norris, Tenn.; and Tuscaloosa, Ala. Most of the research on copper is carried on at Salt Lake City, Tucson, Minneapolis, and College Park.

OTHER GOVERNMENT AGENCIES

Other Government agencies perform or contract for research directly or indirectly involving copper. The Geological Survey conducts fundamental research in geochemistry and geophysics, developing information to aid exploration. The research and development branches of the Army, Navy, and Air Force, investigating properties of metals for specific end-item applications, test copper and copper-base alloys for particular qualities.

RESEARCH AND DEVELOPMENT ASSOCIATIONS

There are three outstanding cooperative associations in the United States whose members are research-conscious producers and/or

fabricators of copper and wrought- or casting-copper-base alloys. These groups are: International Copper Research Association, Copper & Brass Research Association, and Brass and Bronze Ingot Inst.

Foremost among these and world cooperatives of copper companies concerned with technical research is the International Copper Research Association (INCRA), which was the Copper Products Development Association (CPDA) before June 1, 1962. Founded in 1960, this research organization has a membership of 35 copper-producing companies representing mining operations in North America, South America, Africa, and Australia. These companies, which account for approximately 95 percent of the free world copper production, formed this association to promote new and improved uses for copper and its alloys through research in certain fields where new or larger outlets might be found for the larger quantities of copper being mined. The costs of research are prorated to the members on the basis of tonnage of production. The technical director of INCRA works with one committee of technical experts, and one committee of marketing specialists. Committee personnel are employees of the member companies. Engineering and literature surveys are made first to determine potential areas of development; then specific research projects are designed and assigned to laboratories of member companies and commercial non-profit research laboratories or university foundations in the United States and foreign countries.

INCRA is pursuing applied and fundamental research under 10 broad research programs. The projects scheduled, and the organizations carrying out the work under these programs were outlined by INCRA in August 1962 as follows:

Protective Coating Program:

Organic protective coatings:

One project—British Non-Ferrous Metals Research Association, London, England.

One project—Chase Brass & Copper Co., Inc., Waterbury, Conn.

Corrosion Program:

Electrochemical study of pitting:

One project—Cebelcor, Brussels, Belgium.

Copper surfaces (structure):

One project—British Non-Ferrous Metals Research Association, London, England.

Electroforming Program:

Automobile radiators by electroforming:

One project—University of Michigan, Ann Arbor, Mich.

Physical properties of copper electrodeposits (joint project with American Electroplaters Society):

One project—National Bureau of Standards, Washington, D.C.

Copper in Iron and Steel Program:

Grinding balls:

One project—University of Ghent, Belgium.

One project—The Anaconda Company, Anaconda, Mont.

One project—National Casting Co.

One project—Quebec Iron Foundries, Ltd., of Noranda Mines Ltd., Mont Joli, Quebec, Canada.

Properties of cast iron containing copper:

One project—Battelle Memorial Institute, Columbus, Ohio.

Improved Copper Alloys Program:

Copper-rare-earth alloys:

One project—Denver Research Institute, Denver, Colo.

Dispersion strengthening by electroplating:

One project—American Metal Climax, Inc., Carteret, N.J.

Cooperative project with Cast Bronze Bearing Institute:

Cast Bronze Design Manual expansion, Franklin Institute, Philadelphia, Pa.

Copper Compound Program—Smog Control—Fungicides:

Copper compounds in mufflers:

One project—Franklin Institute, Philadelphia, Pa.

Copper Alloys for Molds Program:

Castable alloys for glass molds and plungers:

One project—Philadelphia Bronze & Brass Co., Philadelphia, Pa.

Stainless Copper Alloys Program:

Beta brass alloys:

One project—Anaconda American Brass Co., Waterbury, Conn.

Related oxide studies:

One project—University of Stockholm, Sweden.

Metal-oxide relation studies:

One project—University of Florence, Italy.

Fundamental Research Program:

Mechanics of surface reactions of copper:

University of Arizona, Tucson, Arizona.

Effect of surface dislocations on the physical properties of copper:

University of Ghent, Belgium.

The Copper & Brass Research Association (CABRA) is an organization maintained by 43 copper and brass mills that produce copper and copper-base-alloy sheet, wire, pipe, tube, and shaped products. CABRA has a staff of 35 qualified technicians that compiles standards for brass mill products, publicizes the merits of copper and its alloys, and publishes general and technical information and a variety

of specialists reports concerning copper. The association also encourages research through sponsorship of an annual contest to honor outstanding achievement in the use or application of copper metal. Prizes have been awarded for such developments as a revolutionary molded-circuit (printed circuit) process; a copper current-conductor system for electrified fixed-track, materials-handling equipment—such as ore bridges, overhead cranes, and other industrial facilities; and an all bronze, uniquely designed, church spire.

Membership of the Brass and Bronze Ingot Institute (BBII), founded in 1928, consists of 14 manufacturers of brass and bronze ingot. The BBII initiated its metal research program in 1930 to help foundries by supplying them with accurate detailed physical and chemical specifications for brass and bronze casting alloys. The program was started at the National Bureau of Standards and later transferred to the Battelle Memorial Institute in Columbus, Ohio. The first Battelle project was designed to furnish foundries with badly needed information about mechanical properties of sand-cast copper alloys. From 1944 to 1954, many factors were evaluated, including metal composition, mold materials, method of charging, and rate of pouring. The latest project, begun in 1955 and still aggressively pursued, develops authoritative data about the properties of standard brass and bronze casting alloys. The new information is valued by foundrymen, metallurgists, design engineers, and architects because it allows foundries to produce castings of greater precision and variety than heretofore considered possible.

BIBLIOGRAPHY

- American Metal Climax, Inc. Annual Report. 1960.
 American Metal Market. V. 69, No. 68, Apr. 9, 1962, p. 8.
 American Smelting and Refining Co. Annual Report. 1961.
 The Anaconda Company Annual Report. 1960 and 1961.
 Brass and Bronze Ingot Institute. The 4 Faces of Progress. BBII spec. pub., 1960.
 Cerro Corp. Annual Report. 1960 and 1961.
 Copper & Brass Research Association. Copper & Brass Bulletin. November 1960 and September 1961.
 Copper Range Co. Properties. Monograph in White Pine Lake Copper, v. 1, 1961.
 Mining Engineering. Highlights of Mining and Exploration Technology in 1961. V. 14, No. 2, February 1962, pp. 64-68.
 Howard, Thomas E. Metal And Non-Metal Mining Research in The Bureau of Mines. Min. Eng., v. 14, No. 1, January 1962, pp. 50-52.
 Inspiration Consolidated Copper Co. Annual Report. 1961.
 Iverson, H. G. Bureau of Mines Metallurgical Research. J. Metals, December 1961, pp. 918-920.
 Kennecott Copper Corp. 1960, 1961; All About Kennecott. Monograph, September 1961.
 Mining Engineering. Developments in Geochemistry. February 1962, p. 67.
 Moore, Charles H. Copper Seeks Share of Auto's Future. Am. Metal Market, v. 69, No. 63A, Apr. 2, 1962, pp. 39-41.
 ———. Research Means a Product. Eng. and Min. J., v. 161, No. 10, October 1960, p. 96.
 National Science Foundation. Reviews of Data on Research and Development. NSF 59-46, No. 14, Aug. 1959, pp. 1-2.
 Newmont Mining Corp. Annual Report. 1960.
 Phelps Dodge Corp. Annual Report. 1960.
 Shaw, John F. Operations of a Mining Research Center. Min. Eng., v. 14, No. 3, March 1962, pp. 49-51.

CHAPTER 10.—LEGISLATION AND GOVERNMENT PROGRAMS

INTRODUCTION

The direct interest of the Government in the copper industry is manifested in the forms of regulation, taxation, aid, and participation. Its policy respecting the entire mining industry is one of encouraging development of the natural resources of the Nation to maintain national security and to foster economic growth. The basic mineral law of the United States, which is composed of the Mining Laws and the Mineral Leasing Acts, provides for exploration, development, and extraction by private enterprise of mineral deposits found on federally owned land. The Internal Revenue Code of 1954, as amended and in force on January 3, 1961, contains specific provisions designed to reduce the impact of Federal taxation on the mining industry. Treaties with foreign countries are designed to improve conditions with respect to friendship, commerce, and navigation. Legislation administered by the Securities and Exchange Commission protects the interest of the public and investors against malpractices in the securities and financial markets. Anti-trust laws prohibit activities in restraint of trade, monopolies in commerce, and discriminatory and unfair trade practices.

In addition the Federal Government conducts a number of public service activities in the field of minerals, including the collection and dissemination of statistical, economic, and technical data. Special programs are designed to promote health and safety in mining. The information derived from the work in many projects is disseminated to industry and the general public by press releases, reports, bulletins, and other methods.

REGULATIONS

Mining Laws

The basic mineral law of the United States is composed of Mining and Mineral Leasing Acts which provide for exploration, development, and extraction by private enterprise of mineral deposits found on Government-owned land. The Act of July 14, 1866 (14 Stat. 86; Rev. Stat. 2318) was the first effort of Congress to create a system of Federal mining law. It was the first act giving citizens the right to

enter upon the public domain for mining purposes and undoubtedly stimulated and encouraged development of the mining industry in the West. The Act of May 10, 1872 (17 Stat. 91), incorporating necessary changes to the Act of 1866, became the foundation of present United States mining laws. It continued the policy of free access to public domain for exploration and mining and set forth obligations and rights for unpatented claims and the procedure for acquiring a patent.

Unpatented Claims.—A summary of the steps involved for an unpatented claim follows: One may claim minerals in unoccupied public land by establishing a discovery, marking the boundaries of the location, and recording the claim with the local recording office where required by State law. Thereafter the locator must perform not less than \$100 worth of development work each year; failure to do so opens the possibility of location of the same ground by another party. A locator is not required to record his claim with the Federal Government. Lode locations may not exceed 1,500 feet in length along the vein, and 300 feet in width on each side of the middle of the vein. The United States mining laws do not limit the number of locations that can be made by an individual or association provided each contains a discovery. A valid discovery is one that "would justify a person of ordinary prudence in the further expenditure of his time and means in an effort to develop a paying mine."⁵ Once a valid discovery and location have been made, the locator acquires a vested interest in the mining claim and may begin extracting minerals.

Patented Claims.—Title to claims covered by location may be had by obtaining a patent from the United States. The steps required in patent application proceedings include: Posting of notices on the claim, in the local land office, and in newspapers; proof of citizenship; an official survey; proof of mineral character; proof of \$500 worth of improvements; and presentation of an abstract of title. These proceedings are initiated in the local land offices of the U.S. Department of Interior Bureau of Land Management. After satisfactory compliance with the preliminary regulations a fee or purchase price of \$5.00 an acre is

⁵ *Cameron, et al. v. United States*, 252 U.S. 450, 459 (1920).

required for lode claims. Issuance of a patent gives the claimant complete legal and equitable title and relates back to the date of discovery and location. The owner of a patented claim not only has title to the mineral estate but to the surface as well.

The United States is one of the few countries of the world in which mineral wealth may be privately owned. Transfer of mineral rights and titles among private owners is subject to State laws relating to property titles, sales and conveyances, leases, and contracts.

Indian Lands.—Two general acts of Congress govern development of oil and gas and other minerals on Indian lands. These are the Act of March 3, 1909 (35 Stat. 783; 25 U.S.C. 396), which authorizes leases for mining of lands allotted to individual Indians; and the Act of May 11, 1938 (52 Stat. 347; 25 U.S.C. 396 a-f), authorizing leasing of tribal lands for mining. In addition, there are special acts authorizing or affecting mineral leasing on certain Indian reservations.

All of the authorizing acts relating to leasing Indian lands for mining provide for leasing the lands under regulations promulgated by the Secretary of the Interior. While not all acts require advertisement of the land for bids, Bureau of Land Management regulations in all cases require such advertisement. The acts require execution of the leases by the Indian owners, except minors and persons not of sound mind. In such cases the leases may be executed on behalf of the Indian owners by the Secretary or his authorized representative.

There is a fundamental difference in the interest of the Government regarding mineral development on public domain and on trust or restricted Indian lands. The United States has proprietary interest in public lands, but it is not the proprietor of restricted Indian lands, and leases on such lands can be executed only by the Indian owners, subject to the approval of the Federal Government in its capacity as guardian acting through the Secretary of the Interior. After leases are executed the Government, again as guardian, participates in supervision of operations and regulations.

Import Taxes

The basic legislation imposing duties on imports into the United States is the Tariff Act of 1930. It included copper raw materials on the free list and levied tariffs on copper and copper-base alloy manufactures. Since 1932, the Internal Revenue Code has provided for an excise on imported copper raw materials, copper alloys, scrap, and manufactured products—4

cents per pound on most items. The Internal Revenue Code Tax rates are:

1. Four cents per pound on the copper content of copper-bearing ores, concentrates, other raw materials, and copper and copper-base alloy products.
2. Three cents per pound on all other articles in which copper, including copper in alloys, is the component material of chief value.
3. Three percent ad valorem or $\frac{3}{4}$ cent per pound, whichever is the lesser, on all other imports containing 4 percent or more of copper by weight.
4. No tax is imposed on copper lost in metallurgical processes.
5. Ores or concentrates containing not more than 15 percent copper when imported as a sulphur reagent or for fluxing purposes shall be admitted tax-free in an aggregate amount not exceeding 15,000 tons of copper content in any one year.

All of the excise and tariff rates were adjusted downward as a result of concessions granted by the United States in the General Agreement on Tariffs and Trade (GATT) effective January 1, 1948; March 16, 1949; June 6, 1951; and June 30, 1958. The duties under the Tariff Act of 1930 and the Internal Revenue Code of 1954 and the changes effected by the GATT agreements are shown in table 87.

The first adjustment was included in a treaty with the United Kingdom effective January 1, 1939, when the tariff on brass and bronze tubes was halved—Treasury Decision (TD) 49753. At the GATT conference held at Geneva in October 1947 most all duties on copper were reduced 50 percent, becoming effective on various items January 1, 1948, and March 16, 1949. Again, at the June 1956 GATT meetings in Geneva, the United States agreed to a 15-percent reduction of duties on copper and other metals and minerals in exchange for similar action by other countries with respect to United States exports. The reduction was accomplished in three years, 5 percent per year. The effective beginning date was June 30, 1956, and the rates for most copper forms were: 1.9 cents per pound for fiscal year 1957; 1.8 cents for fiscal year 1958; and 1.7 cents for fiscal year 1959 and thereafter. A provision of the concession specified that if and when the price of copper fell below 24 cents per pound the excise would revert to 2 cents per pound.

The Internal Revenue Code import taxes on copper were suspended by congressional action from April 30, 1947, to June 30, 1958, except for the period from July 1, 1950, to March 31, 1951. Public Law 42, 80th Congress, suspended these duties from April 30, 1947, through March 31, 1949; Public Law 33, 81st Congress, extended the suspension through June 30, 1950; Public Law 38, 82d Congress, suspended the excises from April 1, 1951, through February 15, 1953; Public Law 4, 83rd Congress, amended Public Law 38 to provide for a continuation of the suspension

TABLE 87.—Rates of duty under Tariff Act of 1930 and import tax rates under Internal Revenue Code of 1954, modified by General Agreement on Tariffs and Trade (GATT) ¹

Schedule A import class No.	Tariff paragraph No.	Description	Tariff rates under Tariff Act of 1930				Import-tax rates under sec. 4541, IRC of 1954 ^{2 3}			
			Unit of quantity	Full rate, cents	GATT		Unit of quantity	Full rate, cents	GATT	
					Rate, cents	Effective date			Rate, cents	Effective date
		<i>Copper for smelting, refining, and export</i>								
6400400	1658 (a)	Ore	Pound, copper content.	Free	Free	3/16/49	Pound, copper content.	Free	Free	3/16/49
6400500	1658	Concentrates	do	Free	Free	3/16/49	do	Free	Free	3/16/49
6401800	1658	Regulus, black, or coarse copper; cement copper.	do	Free	Free	3/16/49	do	Free	Free	3/16/49
6401700	1658	Unrefined, black, blister, and convertor, in pigs or convertor bars.	do	Free	Free	3/16/49	do	Free	Free	3/16/49
6401800	1658	Refined in ingots, plates, or bars.	do	Free	Free	3/16/49	do	Free	Free	3/16/49
6401900	1658	Old and scrap copper, fit only for remanufacture; scale or clippings.	do	Free	Free	3/16/49	do	Free	Free	3/16/49
		<i>Copper and copper manufactures, dutiable</i>								
6404100	1658	Ore	do	Free	Free	3/16/49	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6405100	1658	Concentrates	do	Free	Free	3/16/49	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6408100	1658	Regulus, black, or coarse copper; cement copper.	do	Free	Free	3/16/49	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6416100	1658	Unrefined, black, blister and convertor in pigs or convertor bars.	do	Free	Free	3/16/49	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6417100	1658	Refined in ingots, plates or bars	do	Free	Free	3/16/49	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6418100	1658	Old and scrap copper, fit only for remanufacture, scale or clippings.	do	Free	Free	3/16/49	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6418300	1657	Composition metal	do	Free	Free	6/ 6/51	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6430000	381	Copper in rolls, sheets, or rods	Pound, gross	2.5	1.25	1/ 1/48	do	4	2	3/16/49
					1.25	6/30/56			1.9	6/30/56
									1.8	6/30/57
6430010	387	Phosphor or phosphorus copper	do	3			do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6430020	381	Copper engravers plates, not ground	do	7	3.5	1/ 1/48	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6430030	381	Engravers plates, ground	do	11	5.5	1/ 1/48	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
									1.7	6/30/58

See footnotes at end of table.

TABLE 87.—Rates of duty under Tariff Act of 1930 and import tax rates under Internal Revenue Code of 1954, modified by General Agreement on Tariffs and Trade (GATT) ¹—Continued

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Schedule A import class No.	Tariff paragraph No.	Description	Tariff rates under Tariff Act of 1930				Import-tax rates under sec. 4541, IRC of 1954 ²			
			Unit of quantity	Full rate, cents	GATT		Unit of quantity	Full rate, cents	GATT	
					Rate, cents	Effective date			Rate, cents	Effective date
		<i>Copper and copper manufactures, dutiable—Con.</i>								
6420040	381	Copper tubes and tubing, seamless	Pound, gross	7	3.5	1/1/48	do	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6430050	381	Copper tubes, brazed	do	11	5.5	1/1/48	do	4	1.7	6/30/58
					5.25	6/30/56			2	6/30/49
					4.9	6/30/57			1.9	6/30/56
6430060	316 (a)	Telegraph, telephone, and other wires and cables of copper—covered with cotton, jute, silk, or other material, with or without metal covering.	Ad valorem	35%	4.5	6/30/58	do	4	1.8	6/30/57
					17.5%	1/1/48			1.7	6/30/58
					16.5%	6/30/56			2	3/16/49
					15.5%	6/30/57			1.9	6/30/56
6430080	316 (a)	Wire, n.s.p.f.	do	25	15%	6/30/58	do	4	1.8	6/30/57
					12.5%	1/1/48			1.7	6/30/58
									2	3/16/49
									1.9	6/30/56
6430100	397	Manufactures of copper, n.s.p.f., not plated with platinum, gold, or silver or covered with gold lacquer.	do	45	22.5%	1/1/48	Pound, gross	3	1.8	6/30/57
									1.7	6/30/58
6430300	(⁴)	All articles, dutiable, n.s.p.f., containing 4 percent or more copper by weight. ⁵	(⁵)	(⁵)	(⁵)	(⁵)	Pound, gross, or percent ad valorem, whichever is the lower.	3% or 3/4¢	1.5	3/16/49
									1.425	6/30/56
									1.35	6/30/57
									1.275	6/30/58
									1.5% or 3/4¢	3/16/49
									1.4% or 0.36¢	6/30/56
									1.3% or 0.34¢	6/30/57
									1.25% or 0.32¢	6/30/58
6430200	(⁴)	All articles, dutiable, n.s.p.f., copper chief value. ⁶	(⁵)	(⁵)	(⁵)	(⁵)	Pound, gross	3	1.5	3/16/49
									1.425	6/30/56
									1.35	6/30/57
									1.275	6/30/58
		<i>Brass and bronze manufactures</i>								
6453000	1634(a)	Old brass and clippings from brass or Dutch metal, for remanufacture.	Pound, copper content	Free			Pound, copper content	4	2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6458000	381	Brass rods, sheets, plates, bars, and strips	Pound, gross	4	2	1/1/48	do	4	1.7	6/30/58
									2	3/16/49
									1.9	6/30/56
6458200	381	Muntz or yellow metal sheets, sheathing, bolts, piston rods, and shafting.	do	4	2	1/1/48	do	4	1.8	6/30/57
									1.7	6/30/58
									2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6458300	381	Brass tubes and tubing, seamless	do	8	4	1/1/39 ⁷ 1/1/48	do	4	1.7	6/30/58
					2				2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6458450	381	Brazed brass tubes, angles, and channels	do	12	6	1/1/48	do	4	1.7	6/30/58
									2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
6458600	316(a)	Brass wire	Ad valorem	25%	15%	1/1/48	do	4	1.7	6/30/58
					12.5%	6/6/51			2	3/16/49
									1.9	6/30/56
									1.8	6/30/57
									1.7	6/30/58

COPPER

6458900	397	Manufactures of brass, n.s.p.f., not plated with platinum, gold, or silver, or colored with gold lacquer.	do	45%	22.5% 21% 20% 19%	1/1/48 6/30/56 6/30/57 6/30/58	Pound, gross	3	1.5 1.425 1.35 1.275	3/16/49 6/30/56 6/30/57 6/30/58
		<i>Bronze manufacturers</i>								
6459000	316(a)	Bronze wire, includes phosphor bronze wire	do	25%	15% 12.5%	1/1/48 6/6/51	Pound, copper content	4	2 1.9 1.8 1.7	3/16/49 6/30/56 6/30/57 6/30/58
6459000	381	Bronze rods and sheets	Pound, gross	4	2	1/1/48	do	4	2 1.9 1.8 1.7	3/16/49 6/30/56 6/30/57 6/30/58
6459700	381	Bronze tubes	do	8	4 2	1/1/39 ¹ 1/1/48	do	4	2 1.9 1.8 1.7	3/16/49 6/30/56 6/30/57 6/30/58
6459900	397	Manufactures of bronze, n.s.p.f., not plated with platinum, gold, or silver, or colored with gold lacquer.	Ad valorem	45%	22.5% 21% 20% 19%	1/1/48 6/30/56 6/30/57 6/30/58	do	3	1.5 1.425 1.35 1.275	3/16/49 6/30/56 6/30/57 6/30/58
6760020	1620	Bell metal and bells, broken, fit only for re-manufacture.	Pound	Free			do	4	2 1.9 1.8 1.7	3/16/49 6/30/56 6/30/57 6/30/58
6760100	380	German silver, or nickel silver, unmanufactured.	Ad valorem	20%	10%	6/6/51	do	4	2 1.9 1.8 1.7	3/16/49 6/30/56 6/30/57 6/30/58
6760150	380	Nickel silver, sheets, strips, rods and wire	do	30%			do	4	2 1.9 1.8 1.7	3/16/49 6/30/56 6/30/57 6/30/58
8263000	1659	Copper sulfate (blue vitriol)	Pound	Free			do	4	2 1.9 1.8 1.7	3/16/49 6/30/56 6/30/57 6/30/58
8380369	1659	Copper acetate and subacetate (verdigris)	do	do	Free	1/1/48	do	4	2 1.9 1.8 1.7	3/16/49 6/30/56 6/30/57 6/30/58

¹ All products subject to tariff rate plus import tax.

² Import tax was suspended until June 30, 1968, provided price of electrolytic copper delivered Connecticut Valley was 24 cents or more per pound. (Public Law 38, 82d Cong.; amended by Public Law 91, 84th Cong.) When price of copper is less than 24 cents per pound, Mar. 16, 1949, rates are applicable.

³ Copper-bearing ores and concentrates from Cuba were tax free until enactment of the Tariff Classification Act of 1962; by virtue of section 401 of this act preferential or other reduced rates of duty were suspended. Products of Philippine Republic are subject to preferential rates until Jan. 1, 1974

⁴ Import tax is presently collected on composition metal suitable in both composition and shape, without further alloying or refining, for processing into cast forms. (Public Law 38, 82d Cong.; amended by Public Law 91, 84th Cong.)

⁵ This classification is applicable to any product not especially provided for in the Internal Revenue Code of 1954. Products are subject to individual tariff rates plus import tax.

⁶ Treaty between United Kingdom—Treasury Division (TD) 49753.

⁷ Import tax is presently collected on copper sulphate. (Public Law 38, 82d Cong.; amended by Public Law 91, 84th Cong.)

through June 30, 1955; and Public Law 91, 84th Congress, extended the suspension from July 1, 1955, through June 30, 1958. Public Law 38 and subsequent legislation, extending suspension, provided that the suspension would end whenever the average price of copper fell below 24 cents per pound for any calendar month.

The excise tax was reimposed July 1, 1958, at 1.7 cents a pound as a result of the GATT meetings in Geneva in 1956. The 1.7-cent rate was to remain in effect when the price of copper was 24 cents a pound or more; if the price dropped below 24 cents, the tariff was to be 2 cents a pound.

Treaties

Treaties entered into by the United States since World War II have emphasized the encouragement and protection of investment abroad. These treaties cover such subjects as protection of persons and property; establishment, control, and operation of business enterprises; taxation; exchange control; trade and shipping. The treaty provisions, however, are not intended to shield the investor against economic risks to which venture capital is subject.

Provisions of the standard friendship, commerce, and navigation treaty regarding the right of nationals and companies of either treaty country to engage in mining activities in the other include the following:

1. Limitation of alien participation in mining activities: Mining activities are excluded from coverage under the national treatment rule because existing legislation limits the right of aliens to engage in mining or to hold interests in mining enterprises in the United States.

2. Protection of established mining enterprises: A general reservation for mining raises the question of affording a proper measure of treaty protection for established mining enterprises or those permitted to become established. Foreign countries may permit alien mining enterprises to become established and operate within their territories and may accord them national treatment. Hence the treaty usually provides that new restrictions permissible under the reservation for mining activities shall not be applicable to alien enterprises existing and doing business in this field at the time such new restrictions become effective.

3. Most-favored-nation treatment: A provision covering mining as well as other economic activities usually assures protection against discriminatory application of such alienage restrictions as may be adopted in this field.

4. Reciprocity: It is usually provided that any rights to engage in mining on the public domain to which an alien enterprise may become entitled through operation of the most-favored-nation rule may be made dependent upon reciprocity.

The provisions of treaties most directly related to mineral production are those concerning taxation of royalties. Several U.S. treaties reduce such taxes or exempt U.S. citi-

zens from them on the basis of reciprocity. The general purpose of these treaties is to eliminate wherever possible double taxation existing between two countries.

Legislation modifying the protection objectives of tariffs and excise taxes has been enacted from time to time, beginning with the Reciprocal Trade Agreements Act of 1934. Under the Act, the President can reduce tariffs or other import restrictions on goods from foreign sources in return for reduction in their barriers against U.S. goods. The Congress has extended the authority a number of times. The Act is explicit in stating its objectives. It authorizes the President to enter into foreign trade agreements for the purpose of expanding foreign markets for products of the United States. This authority delegated to the President is subject to certain limitations. No duty may be increased or decreased by more than 50 percent and no article may be transferred between dutiable and free list. See GATT concessions under section on import taxes.

Securities Regulations

Securities of companies engaged in the mining and mineral industries are subject to the Securities Act of 1933 and related legislation administered by the Securities and Exchange Commission. The general purpose of these laws is to protect the interests of the public and investors against malpractices in the securities and financial markets. These laws provide for public disclosure of pertinent facts concerning new securities offerings to the public and securities listed on exchanges; regulation of trading in securities on exchanges and in over-the-counter markets; enforcement of sanctions against companies and persons guilty of securities frauds and other violations; supervision of investment companies engaged in purchase and sale of securities; regulation of investment advisers; and advice by the Securities and Exchange Commission to courts in proceedings for reorganization of bankrupt companies. Certain mining companies are exempt under section 3 of the Securities Act of 1933, which authorizes the Commission to exempt from registration requirements securities with an aggregate offering price not exceeding \$300,000.

Anti-Trust Laws

The principal anti-trust statutes now in effect are the Sherman Act (1890) and the Clayton Act (1914), as amended by the Robinson-Patman Act (1936). Associated with these statutes are the Federal Trade Commission Act (1914) and other related statutes applicable to

this field. The laws apply to all business activity, including the mining industry, and prohibit activities among private individuals or firms that are designed to restrain trade or commerce or cause monopoly in commerce between States, with foreign nations, or in territories of the United States. They also prohibit discriminatory and unfair trade practices.

The Sherman Act prohibits contracts, combinations, or conspiracies which restrain interstate or foreign commerce. It also prohibits monopolies, attempts to monopolize, and conspiracies to monopolize domestic and foreign trade.

The Clayton Act of 1914, as amended, makes unlawful tied leases or sales and acquisition by one company of the stock or assets of another when the effect may be to substantially lessen competition or tend to create a monopoly in any line of commerce. It forbids interlocking directorates under certain circumstances. It makes it unlawful for persons to discriminate in price between different purchasers of commodities of like trade and quality to lessen competition or create a monopoly. It also prohibits commissions or discount allowances on goods in interstate commerce, except for services rendered, and forbids discriminations in rendering services, giving rebates or discounts, or underselling to destroy competition.

The Federal Trade Commission Act prohibits unfair methods of competition and unfair or deceptive acts or practices in interstate or foreign commerce.

Government Barter Program

The barter program was originally developed to acquire materials for the strategic stockpile authorized by Public Law 520, 79th Congress, approved July 23, 1946. Little barter was done until after passage of Public Law 480, 83rd Congress, authorizing establishment of a supplemental stockpile for strategic and other materials acquired by disposing of surplus agricultural commodities. Interdepartmental committees directed first by the Munitions Board then by the Office of Civil and Defense Mobilization (OCDM) or its predecessor agency, Office of Defense Mobilization (ODM), designated the kinds and quantities of material to be acquired through barter. With the passage of Public Law 85-931, September 1958 and subsequent Executive action, this responsibility was transferred to the Secretary of Agriculture.

Copper was eligible for barter negotiations from the latter part of 1955 to early 1956 and again from the middle of 1957 until almost the end of 1958 when it was taken off the barter list. Beryllium copper was on the list from

March to September 1956; oxygen-free, high-conductivity copper (OFHC) became eligible in September 1961 and was on the list authorized through fiscal year 1962.

TAXATION

Most forms of taxation are employed by the Federal and State Governments and to some extent by local governments. The revenue systems used overlap in many instances. Exceptions are custom duties which are imposed only by the Federal Government and property, severance, franchise, general sales, and motor vehicle license taxes which are employed only by State and local governments. The types of taxes most important to producers of copper are: Income taxes, severance taxes, and property taxes.

Income Taxes

The Federal Government and a few of the State Governments levy taxes on incomes of copper-producing corporations. Because virtually all the copper mined and processed in the United States is done by corporations, this discussion will be confined to corporate taxes.

The Federal tax on corporation income originated as an excise tax in 1909 and was levied at the rate of 1 percent on net income in excess of \$5,000. This excise tax was superseded by the income tax law of 1913, which followed adoption of the 16th amendment to the Constitution of the United States. Corporation income taxes have been an important part of the Federal revenue system, having contributed annually between one-sixth and one-half of total Federal tax revenues. Since World War II, the corporate income tax has been second only to the individual income tax in importance.

Corporations producing copper are subject to a normal tax of 30 percent on the total amount of taxable income and a surtax of 22 percent on taxable income in excess of \$25,000. Generally taxable income is gross income less the actual monetary costs of producing that income. However, the tax law contains several special provisions regarding income derived from mineral deposits (natural resources). In recognition of the wasting character of mineral deposits, a special deduction, known as percentage depletion, is allowed which may have no relationship to actual costs. In addition, the tax law provides special treatment for certain capital expenses incurred in finding and preparing mineral deposits for production, Federal Government loans or grants for encouraging exploration, development or mining strategic minerals or metals, and taxable income earned in foreign countries.

Depletion Allowance

Capital invested in copper properties may be recovered tax free through depletion allowances. These allowances are computed according to a cost depletion or a percentage depletion method, the taxpayer being required to take the higher of the two. To compute allowable depletion under the cost systems, the adjusted basis of the property which would be used for determining the gain upon the sale of such property is divided by the total estimated remaining units (tons of ore, pounds of metal) and the result is multiplied by the number of units sold during the year. Cost depletion deductions are exhausted when the adjusted basis of the property has been reduced to zero.

Allowable depletion under the percentage depletion method is computed as a special percentage of gross income from the property but must not exceed 50 percent of the net income. Percentage depletion allowances may be claimed on the income from a property although the estimated value has been completely written off through prior cost or percentage depletion. The percentage depletion allowance on income from copper mines (domestic or foreign) is 15 percent.

Exploration and Development Costs

Sections 615 and 616 of the 1954 Revenue Code permit the taxpayer either to write off the costs of exploration and development of mineral deposits as they occur or to set up these costs as deferred expenses to be deducted proportionately over the life of the deposit. Expenditures covered are those required to ascertain the existence, location, extent, or quality of any ore or mineral deposit, or for shafts, tunnels, raises, stripping, drainage and other items attributable to development of the mine or deposit until it reaches a level of full production.

Deductions for exploration expenditures are limited to \$100,000 per year and to a total of \$400,000. The current expense deductions for exploration and mine development costs were first granted in the Revenue Act of 1951, which limited the annual deduction for exploration expenses to \$75,000 in each of any four years; the 1954 code raised this limit to \$100,000. In 1960, the 4-year limitation was replaced by a total limitation of \$400,000, which may extend any number of years. This ceiling limitation is not applicable to unsuccessful exploration projects. Expenditures for such operations are deductible as operating losses regardless of amount.

Federal Loans or Grants for Exploration, Development, or Mining

Recipients of loans or grants from the United States (or any agency or instrumentality thereof) for encouragement of exploration, development, or mining of critical and strategic minerals or metals for national defense may exclude such loans or grants from income.

Income From Foreign Sources

Generally, domestic corporations are subject to Federal income tax on their entire income, regardless of where the income was earned. Because income taxes of most countries apply to all income derived within their jurisdictions, this feature of the U.S. law would result in substantial double taxation were it not for basic provisions designed to relieve such situations. Some double taxation is eliminated by specific treaties with various countries. In addition, the Federal income-tax law includes several statutory provisions adjusting income-tax liabilities. These include (a) the deduction of foreign taxes paid, (b) credit for foreign taxes paid, and (c) special tax-rate reductions for Western Hemisphere trade corporations. Also, special consideration is accorded corporations operating in U.S. possessions.

In determining the United States liability, corporations subjected to foreign income taxes may either:

1. Deduct the full amount of foreign taxes paid from their gross income; or
2. Take a credit against U.S. income tax for income, war profits, or excess profits tax (or other taxes in lieu of such taxes) paid to a foreign country or to any possession of the United States. The credit limitation is based on Sections 901, 902, 903, and 904 of the Internal Revenue Code of 1954, as amended.

Western Hemisphere trade corporations, defined as U.S. corporations whose total business is done in North, South, or Central America or the West Indies, are granted a special rate reduction of 14 percentage points. To qualify they must satisfy the following requirements for 3 years immediately preceding the close of the taxable year:

1. Ninety-five percent of their gross income must be derived from sources outside the United States.
2. Ninety percent of their gross income must be derived from active conduct of a trade or business.

If a Western Hemisphere trade corporation is a subsidiary of another U.S. corporation, dividends received by the latter are subject to the regular tax on dividends received, that is,

52 percent on 15 percent of such dividends. The Western Hemisphere trade corporation may credit its foreign taxes against its U.S. tax.

State Income Tax

Only three of the seven major copper producing States levy income taxes on corporations engaged in mining—Arizona, New Mexico, and Tennessee. Rates are moderately low and are not progressive; except for very small taxable incomes, when a sliding scale may be used. The determination of gross income, and the deductions allowed to compute net or taxable income, are patterned after the Federal Tax System. Two States, Montana and Utah, base their corporation franchise taxes on net income.

General Property Taxes

The Federal Government does not levy property or ad valorem taxes on the value of mineral or surface rights or plant facilities owned by mining companies. In most States such taxes provide the principal revenues for counties, municipalities, and school districts. States tend to rely on franchise, income, and other specific taxes for their revenues and to leave property taxation to local governmental units.

The tax base varies from State to State, and some States have variations in certain sections. The basis for taxation of property in some States is present worth, in others it is net proceeds, and a few States use both. Present worth is evaluated by a number of methods with tax rates ranging from 1.5 to 10 percent. Reasons for the wide spread are:

1. The ratio that the assessed value bears to the true value.
2. The need of the district for revenue. Present worth is considered differently in some States. In Michigan, mining plants and equipment are exempt from taxation, but ore bodies are carefully appraised for present worth. In Tennessee only real estate and plant facilities are subject to the property tax.

Severance Taxes

Severance taxes, like royalties, are based on gross production. A true severance tax is one measured by applying a specific rate per unit (ton, pound) to the total quantity produced. Alternatively, the measure is a percentage of the gross value of the material removed or severed during the tax period.

Four of the major copper producing States are recorded as imposing severance taxes;

however, in Arizona it is classified as a sales tax, in Montana it is called a Mine Metal License, and in Utah it is known as an Occupational Tax. These all apply if no profit is realized from the operation of producing, and therefore are rightfully considered severance taxes. New Mexico levies a severance tax and a sales tax, which is essentially another severance tax.

GOVERNMENT LOAN PROGRAMS

Exploration Loans

By direction of the Defense Production Act of 1950, the Defense Minerals Exploration Administration (DMEA) was created in 1951 to promote exploration for unknown and undeveloped sources of strategic and critical metals and minerals in the United States, its territories, and possessions by providing financial aid for exploration projects. Such assistance was furnished pursuant to exploration project contracts with provisions requiring specified exploration by the operator, Government participation in payment of costs as they accrue, and repayment of the Government share by the operator from net proceeds of production resulting from the exploration work.

For copper exploration projects, the Government and operators each shared 50 percent of the costs. Through June 30, 1958, the DMEA had entered into 53 contracts for exploration of copper deposits. As of December 31, 1958, the total estimated approved cost was \$3,485,182 of which the Government share was \$1,742,591. Copper reserves were developed in several areas as a result of this program.

Public Law 701 enacted in 1958 established the Office of Minerals Exploration (OME) in the Department of the Interior. OME assumed the functions and obligations of DMEA. Under OME, copper continued eligible for exploration assistance; through December 31, 1960, three new contracts and an amended contract were executed for an estimated total cost of \$144,650, the Government share being \$72,325.

Export-Import Bank Loans

The purpose of the Export-Import Bank, as stated by Congress, is "to aid in financing and to facilitate exports and imports and the exchange of commodities between the United States or any of its territories or insular possessions and any foreign country or the agencies or nationals thereof." The Bank has provided financing in connection with the expansion of copper production in Peru, Chile, and Turkey.

The \$237-million project of the Southern Peru Copper Corp. that was started in 1955 for developing the Toquepala mine and constructing a concentrator and smelter was partly financed by Export-Import Bank loans totaling \$110 million. Production began January 1, 1960, and as of December 31, 1961, this debt had been reduced to \$89,199,992. In 1959, an Export-Import Bank credit of \$1.5 million was granted to Eti Bank, an agency of the Turkish Government, for developing new production facilities at the Government-owned Ergani mine. An Export-Import Bank loan of \$45,000,000 was approved in 1962 for Compania Minera Andina, S.A., a subsidiary of Cerro Corp., as partial financing of an \$80-million project to bring the Rio Blanco copper property in central Chile into production.

PUBLIC SERVICES

Collection and Dissemination of Basic Data

The Department of the Interior, through the Bureau of Mines and the Geological Survey, conducts scientific and technologic investigations and statistical studies directly pertaining to mining, preparation, treatment, and utilization of minerals. Data also are collected concerning health and safety conditions in the mining industry. This information is disseminated to industry and the general public by press releases, reports, bulletins, and other methods. The Department of Commerce conducts statistical and census studies and provides economic and technical data to the minerals industries and the general public to promote and develop domestic commerce.

Government Technical Assistance

The Federal Government renders technical assistance relating to production and utilization of minerals in both domestic and foreign areas. Much of the technical research is done under cooperative agreements with institutions, States, foreign governments, and private and public organizations. Surveys and studies are made to determine and appraise the distribution and reserves of mineral deposits. The Federal Government also collects and disseminates technical and statistical information on domestic and foreign mineral activities, renders services that assist the minerals industry and the general public, and conducts and assists in training programs.

Mine Health and Safety

Health and safety in mining is advanced by the work of the Bureau of Mines, the Public Health Service of the Department of Health, Education, and Welfare, and the Department of Labor.

FOREIGN MINERAL LAWS

A summary presentation of mining laws, effective in most mineral-producing areas of the world, dealing with the mineral codes governing acquisition and tenure of mineral rights and regulations for exploration and exploitation of mineral lands in foreign countries was published in 1961.⁶

Unlike the United States, most foreign governments either maintain ownership or control the title to all mineral lands but grant the right to work the minerals by some form of permit or concession. Eligibility for such rights is subject to conditions and obligations which vary greatly from country to country. Principal legal controls in the major copper-producing countries are discussed in the following sections.

Canada

The Provincial governments of Canada hold legal title to all public (crown) lands except Indian reserves, national parks, the Northwest Territories, and the Yukon, which are owned and administered by the Dominion Government. Aliens, citizens, and other British subjects 18 years of age or more, or authorized corporations, are entitled to engage in prospecting or exploration on crown lands in the Dominion or Provinces. Rights to mine and extract ore are usually granted by renewable 21-year leases, except in Newfoundland, where the period is 50 years. Annual assessment requirements range from \$100 per claim to 80 man-days of work. There is specific legislation regulating conservation, health and safety, and other activities of the minerals industry.

Operators of metalliferous mines are given a percentage depletion allowance of 33½ percent. New mines may be granted exemption from income tax for 36 months. Other Dominion laws govern tariffs, excise taxes, explosives, and special assistance to coal and gold mines.

Chile

The State owns all minerals, whatever the surface ownership. Concessions to work certain minerals are granted under the mining code,

⁶ Ely, Northcutt. Summary of Mining and Petroleum Laws of the World. Bu. Mines Inf. Circ. 8017, 1961, 215 pp.

which permits unrestricted prospecting for minerals on lands not cultivated or enclosed; otherwise, permission of the occupant is required. Exploration of state or municipal lands requires permission of the governor or mayor. Any alien or citizen, except certain Government officials, is eligible for an exploitation or mining concession, which is a multiple of claims of not less than 1 nor more than 5 hectares. The holders of mining concessions are entitled to certain easements that the surface owner must allow in order to facilitate mining operations and that the law imposes upon holders of other concessions.

Until 1952, the Chilean Government obtained its revenues on Chilean copper production through taxes and exchange rate policies and did not participate in sales. However, after the copper sales agreement between the United States and Chile on May 8, 1951, providing that 80 percent of Chilean output be sold in the United States at 3 cents above the market price and the balance be sold by the Chilean Government, legislation was approved authorizing control of amounts to be exported freely by the companies and to be delivered to the Central Bank, the Government agent. Chile abrogated the agreement with the United States on May 8, 1952, and gave the Central Bank control of all sales of copper; the bank immediately set minimum prices for that metal. An accumulation of unsold copper reached 180,000 tons in late 1953, and serious cutbacks in Chilean production were avoided by purchases for the United States stockpile in March 1954. At this time legislation to improve conditions for the major producers (*gran mineria*) was introduced, but did not become law until May 5, 1955. Until this law was passed taxes and the exchange differential imposed on the *gran mineria* were approximately 84 percent of profits. The new copper law imposes a tax on net income at a rate between 50 and 80 percent. The specific rate for any one company is determined by a relationship between its production for the year and a base production fixed under the terms of the new copper law. The rate decreases as production increases. Special deductions in computing taxable income are given the three companies in the *gran mineria*—Andes Copper Mining Co., Braden Copper Co., and Chile Exploration Co.—for approved new investments in electrolytic copper-producing installations.

Mexico

To encourage greater participation by Mexican citizens in mining, the Mining Law of February 6, 1961, was enacted to regulate

exploitation of Mexican mineral resources. The law provides that only Mexicans or Mexican corporations with a majority of the capital subscribed by Mexican nationals can qualify to obtain new concessions or to acquire concessionary rights by transfer or assignment. The law restricts the future role of private foreign mining investments. As an inducement for "Mexicanization" of operating companies in Mexico that are predominantly owned by private foreign capital, an amendment provides that mining companies 51-percent owned by Mexican nationals are entitled to receive a 50-percent reduction in production and export taxes on their mining activities. The amendment states that companies that change their capital structures to 51-percent Mexican ownership may also qualify for the 50-percent tax reduction.

To encourage new large investments in copper production, Article 2 of the copper law provides that new companies in the *gran mineria* category will be subject solely to a flat 50-percent tax. The law also provides that amounts needed by the copper companies for expenses in Chile shall be returned in U.S. dollars and sold to the Central Bank at the free-banking rate and that producers are obliged to reserve bar copper required by national industry, including amounts needed for exportation of fabricated and semifabricated products.

Peru

In Peru all mines and minerals are the property of the State. Surface rights to land are separate from the estate in minerals underground. Mining is open to aliens, citizens (except certain Government officials), or corporations; however, foreigners may not have mines within 50 kilometers of the frontier without special permission of the Government. Exploration and exploitation rights are acquired by concessions granted by the Ministro. Exploration concessions are valid for 5 years, but the right to produce minerals after discovery may continue indefinitely. The State is authorized by law to set aside certain mineral reserves, which the National Government may operate directly or may lease to private individuals or corporations.

Special tax laws apply to mining. The application fee or tax for an exploration concession is S/.05 per hectare and S/.1 per hectare for an exploitation concession. Exploitation concessions for metals other than gold are subject to surface taxes of S/.20 per hectare. If after 5 years of exploitation the amount paid for wages and materials does not exceed S/.50 per hectare per year, an excess surface tax equal to the regular

surface tax is imposed and may be credited against subsequent income taxes. These taxes are in addition to profit taxes which are levied on net income. Foreign branch offices also pay a complementary surtax levied on profit tax income. The combined profit tax and complementary tax levies amount to approximately 21 percent of net income before depletion.

Under the income tax law special depletion reserves may be set up from 15 percent of gross revenues for metallic concessions, not exceeding 50 percent of the net profits in any 1 year.

Payments of 4 percent of value on ore exported in excess of S/800,000 per year is required currently from each concessionaire. This payment is credited against the annual profit tax.

Special arrangements may be made with the Executive for royalty payments of from 10 to 20 percent of the profits in lieu of income taxes; or the Executive may agree to set the income tax rate between 10 and 20 percent for a specified period to encourage general development.

Republic of the Congo

Assuming the Congolese law applicable to mineral development will continue under the new government, the following is a summary of the principal regulations:

Mines constitute property distinct from that of soil, and they are the exclusive property of the State. Concessions to exploit mineral resources are granted by the Government, and to a lesser extent by three concessionaires. Persons who have fulfilled the formalities for Congo residence and who have completed the formalities for doing business in the Republic can apply for prospecting rights. Concessions granted by permit are limited to territories declared open to public prospecting. Areas covered by the special concession by convention are not so limited. Less than half of the Congo is open to public prospecting. In order to obtain a concession by permit the applicant must fulfill the requirements of a three-phase procedure—the general prospecting permit, the special prospecting permit, and the exploitation permit. A fourth phase, the treatment permit, is optional. Fixed fees are charged for general and special permits and are doubled with each renewal. No fees are assessed for exploitation or treatment permits.

Royalties of one-tenth the value of the minerals extracted are assessed against a special permit holder. Exploitation royalties are based on the amount of the concessionaires capital. The rate varies, with a maximum of 50 percent payable on profits of more than 35 percent of the invested capital. An exception provides that during the first 5 years of operation the royalty payments shall not exceed 10 percent if, during the period, the company has not paid a dividend equal to at least 5 percent of the capital invested.

Federation of Rhodesia and Nyasaland

The British South Africa Co. through a charter granted by the British Government possesses and administers the mineral rights of Northern Rhodesia and about 16,000 square miles in Nyasaland. These rights in Northern Rhodesia will expire in 1986. The mineral rights of the company in Southern Rhodesia were purchased from the British South Africa Co. by the Southern Rhodesian Government on June 29, 1933.

All prospecting in Northern Rhodesia and Nyasaland must be authorized by permit granted by the British South Africa Co. The company encourages prospecting and issues permits without discrimination as to race or nationality. Individuals or companies may obtain nontransferable prospecting licenses which are effective for one year. License holders are required to register them at the Office of the Commissioner of Mines. The mining company and individual are obliged, upon acquiring mineral concessions from the company, to spend stipulated amounts annually on exploring any mineral area and to pay certain royalties to the British South Africa Co. when the production stage is reached.

Royalty is payable on the copper content of materials produced each month, the rate per long ton being 13.5 percent of the average of London Metal Exchange quotations for the month, less £8. Royalty payments are based on blister copper, and the price is obtained by deducting £8 from the price of electrolytic wirebar unless the metal is sold in blister form. Twenty percent of the net revenue derived by the British South Africa Co. from the exercise of its mineral rights in Northern Rhodesia is paid to the Northern Rhodesia Government.

BIBLIOGRAPHY

- American Smelting and Refining Company. Annual Reports. 1955-61.
- Bohan, Merwin L., and Morton Pomeranz. Investment in Chile. U.S. Dept. Commerce, April 1960, pp. 85-90.
- Borden, Granville S. Taxation of Mineral Properties. Ch. 10 in Econ. of the Min. Ind., AIME, 1959, pp. 451-496.
- Ely, Northcutt. Summary of Mining and Petroleum Laws of the World. BuMines Inf. Circ. 8017, 1961, 215 pp.
- Ely, Northcutt, and Charles F. Wheatley. Mineral Titles and Tenure. Ch. 3 in Econ. of the Min. Ind., AIME, 1959, pp. 81-130.
- Just, Evan. Government Aid and Regulation. Ch. 12 in Econ. of the Min. Ind., AIME, 1959, pp. 545-562.
- Parsons, A. B. Taxation of Mineral Enterprise. Prelim. Rept. to Director BuMines, Aug. 1, 1949, 22 pp.
- U.S. Bureau of Mines. Copper. A Ch. in Minerals Yearbook 1959, v. 1, 1960, p. 419.
- U.S. Congress, House Committee on Ways and Means. Tax Revision Compendium. V. 1 and 2, 1959, 1536 pp.
- U.S. Congress, Joint Committee on Internal Revenue Taxation. Internal Revenue Code of 1954, as amended and in force January 3, 1961. 1961, p. 231-244.
- U.S. Congress, Joint Economic Committee. The Federal Revenue System: Facts and Problems 1961. 1961, 290 pp.
- U.S. Office of Indian Affairs, Department of the Interior. Regulations Governing Leasing of Restricted Allotted Indian Lands for Mining Purposes. 1937, 14 pp.
- U.S. State Department. Foreign Service Dispatch No. 774, Mexico City. Jan. 11, 1961, pp. 6-8.

CHAPTER 11—STRATEGIC FACTORS

INTRODUCTION

The necessity for regulating supply of important industrial minerals and metals was recognized toward the end of World War I. On March 23, 1917, Bernard Baruch stated, "The United States is deficient in certain minerals of great importance, particularly in war time; the deficiency being due to actual lack of suitable ore deposits, or the fact that our deposits are low grade and more expensive to work. The remedy may mean . . . the accumulation of a reserve supply, either by government or private companies, the stimulation of home production by assurance from competition, research to develop cheaper processes to utilize low grade ores, stimulation of exploration and discovery of new deposits, or development of substitutes and new uses for various products." The final report of the War Industries Board recommended a U.S. stockpile of strategic materials. Later, proponents of U.S. self-sufficiency in certain mineral supplies expressed numerous warnings and made many recommendations regarding stockpiling and broadening our mineral base, but nothing was done until Congress passed the Strategic Materials Act of 1939.

In preparing the pre-World War II lists of strategic and critical materials, the Army and Navy Munitions Board established the following definitions:

Strategic Materials: "Those essential to national defense, for the supply of which in war, dependence must be placed in whole, or in substantial part, on sources outside the continental limits of the United States."

Critical Materials: "Those essential to national defense, the procurement problems of which in war, would be less difficult than those of strategic materials."

Copper was classed as a nonstrategic and noncritical metal because the depression in the early 1930's and a decade of excess productive capacity precluded the concept of a copper shortage. A subcommittee report to the Chairman of the Minerals Advisory Committee of Army and Navy Munitions Board (ANMB), on April 8, 1939, stated, "No contemplated national emergency could call for supplies of copper in excess of those readily available from present mines and plants." And in its final version of the Industrial Mobilization Plan in 1939, ANMB did not include copper as either a strategic or critical material. It was listed as one of the important minerals which should be kept under surveillance. The position of the Board was

reaffirmed in November 1940 through a memorandum to the National Defense Advisory Council which said—if the mining and smelting capacity of Mexico and South America were considered to meet part of the national needs—there seemed "Very slight basis for a belief that a serious shortage of copper could develop under the imperative requirements for this metal due to a major war."

DEVELOPMENT OF COPPER CONTROLS

In the year before World War II, however, copper ranked next to aluminum as the most difficult of critical metals to obtain in sufficient quantities. This change in the position of copper was due principally to revised military estimates and to large and rapidly growing commitments of the Lend Lease Act and the Russian Protocol. When it was evident that copper was rapidly becoming scarce the first measures for increasing imports were passed, and mandatory priorities were issued. The first organization for controlling copper was the National Defense Advisory Commission, consisting of seven advisors—each in charge of an area in the national economy: Industrial production, industrial materials, employment, prices, farm products, transportation, and consumer interests. The first steps taken to conserve and increase the copper supply were: (1) Placement on the list of materials requiring license for export, and (2) Authorizing Metals Reserve Co. to purchase 100,000 tons of foreign copper.

At the beginning of 1941 the President created the Office of Production Management (OPM) for more concentrated governmental supervision over production, purchasing, and priorities. On April 30, OPM issued General Metals Order Number 1 to control the inventories of 16 specified metals, including copper. The order was addressed to all producers, smelters (primary and secondary), remelters, brokers, distributors (warehouse or wholesale), processors, and fabricators of the designated materials. The terms of the order restrained any supplier from knowingly delivering any of the specified metals to a purchaser or the purchaser from receiving such metal if such delivery increased the inventory of the purchaser beyond stated levels.

Because of the mounting shortage of copper,

mandatory priority controls were required to control supplies, and General Preference Order M-9 became effective May 31, 1941, "To conserve the supply and direct the distribution of copper." The objective of the order was to direct copper into defense uses first, leaving only the overflow available for civilian requirements. In contrast to later conservation orders which prohibited specific uses, order M-9 was implemented through preference ratings.

Although all producers of copper wire mill, brass mill, and brass or bronze foundry products were required to comply with the demands of the preference rating system, the order was addressed primarily to producers of copper in its nonfabricated form. The principal points of the order may be summarized as follows:

1. All defense orders not bearing a preference rating of A-10 or higher were automatically assigned an A-10 rating—conversely all nondefense orders were restricted to ratings lower than A-10.

2. Nondefense orders could be filled only after defense orders, and then only on the condition that filling them neither delayed the delivery of a defense order nor required use of metal that was needed under the order for a reserve pool.

3. Beginning June 1, 1941, each refinery was required to set aside each month an amount of copper equal to 20 percent of his production in April 1941. Production for the individual refiner included copper refined for the company on toll and excluded metal refined by it for others.

4. Quantities thus withheld were subject to allocation by the Director of Priorities to meet emergency requirements.

5. Beginning June 1, 1941, all copper held by the Metals Reserve Co. was made subject to allocation by the Director of Priorities.

6. Copper was removed from control under General Metals Order Number 1. To continue the safeguards of this order, the new copper order contained restrictive provisions—directed to the supplier as well as the purchaser—against building excessive unnecessary inventories of copper.

Allocation of Copper

The growing pressure of requirements for copper, including those for the United Kingdom and Lend Lease, created problems that could not be solved with order M-9. Thus, plans were made to place copper under complete mandatory control with 100 percent of the copper available subject to allocation. The resulting General Preference Order M-9-a became effective August 6, 1941. Under this order no copper produced from domestic ores could move from refineries, except as specifically allocated by the Director of Priorities. The basis used to make the allocations, effected through allocation certificates, was the character of the business of the fabricator, indicated through its preference ratings. The new order incorporated the same directive features for deliveries by manufacturers of copper and copper-base-alloy products that were contained

in the replaced order M-9. The principal contribution of the allocation system was that it channeled copper to the areas required by priorities certificates.

Control of Scrap

Since nearly half the total supply of copper available to fabricators of copper and copper-base-alloy products was derived from secondary or scrap copper, extension of priority controls to cover this portion of supply was effected September 30, 1941, by Supplementary Order Number M-9-b which was issued to conserve the supply and direct the distribution of copper scrap and copper-base-alloy scrap. The order provided that all scrap generated in the further fabrication of brass mill products must be returned either directly or through dealers to brass mills. The principal provisions governing all other scrap, as defined in the order, may be summarized as follows:

1. Deliveries were restricted to dealers, or to fulfillment of orders bearing a preference rating of A-10 or higher, with certain exceptions applying to deliveries to foundries until November 1, 1941.

2. Deliveries, including deliveries of brass-mill scrap under toll agreements, were prohibited unless approved by the Director of Priorities.

3. Dealers were prohibited from melting scrap without specific authorization, or from receiving scrap unless they had turned over their inventory within a 60-day period and had filed required reports with OPM.

With this order all raw material sources for manufacturers of copper and copper-base-alloy products were under the control and direction of OPM.

Conservation and Limitation Orders

Orders M-9-a and M-9-b were both directed toward conservation, but this aim was incidental to that of directing the flow of copper into defense channels, which frequently were not preferred commercially. The control provided by these orders was not adequate and leakage of copper into nonessential uses was inevitable so long as the manufacture of such products was not specifically prohibited. Recognition of this lack of control and constantly increasing defense demands led to issuance of a prohibitory order designed to control uses beyond the reach of the original orders. This order, aimed at conservation by preventing manufacture of certain products and by definitely limiting manufacture of other products using copper, was known as Conservation Order M-9-c and was issued October 21, 1941.

Supplementing the direct control over copper exercised through the M-orders was the indirect control over use of copper that was enforced through the limitation or L orders. These

orders effected conservation of copper and other critical materials through limitations on manufacture of products involving use of one or more critical materials. These orders were expected to reduce consumption of scarce materials in the automotive, domestic-mechanical refrigerator, and household-laundry-equipment industries—three leading durable goods consuming industries—by as much as 50 percent in the ensuing 12 months. The orders affecting these industries were respectively Limitation Orders L-2, L-5, and L-6.

The need for continued control of production and distribution of copper and copper-base-alloy products was more urgent after Pearl Harbor. Order M-9-a was amended January 7, 1942, to provide tighter control over copper by (1) placing privately imported copper, except duty-free copper for re-export, under the controls of the order; (2) requiring that toll agreements for processing copper must have the approval of the Director of Priorities; (3) prohibiting previously allowed deliveries of 50 pounds or less of copper per month to a single customer without preference rating; and (4) requiring that copper must "Be physically incorporated into the material or equipment to be delivered" before it could be rated as a defense order. Further amendment to the order provided for replenishment of stock sold for war orders. Except for minor amendments adopting the order to meet changed operating conditions, clarifying terms of the order, and changing reports required of industry, the order as thus amended continued through 1942 as the basic control over manufacture and distribution of copper.

Production Requirements Plan

A major step in the evolution of basic control devices was introduction by the War Production Board of the Production Requirements Plan, generally known as PRP. The plan was described as "A streamlined scheme for granting priority assistance to manufacturers engaged in essential production." Its principal objectives were to simplify the use and issuance of priorities and to provide better overall information on material requirements and end-product uses to facilitate scheduling material production and distribution.

The plan as introduced, may be briefly outlined as follows:

1. Except for certain industrial users not fabricating material for resale, all concerns using in any quarter more than \$5,000 worth of metals included under the plan had to apply under it for preference ratings covering their requirements for such metals.

2. Applicants under the plan had to report their consumption and inventories of the metals involved in addition to their requirements for such metals—listing by preference ratings.

3. From tabulations of reported requirements, the Armed Services, the Civilian Supply Division and Industrial and Material Branches of the War Production Board (WPB) submitted overall end-use allocations of the respective materials to the Requirements Committee.

4. Using these proposals, and taking the advice of the Requirements Committee, the Committee chairman issued tentatively adjusted requirements that, following review by and receipt of recommended changes from the respective agencies concerned, were adopted or modified by the chairman as the broad determinations of the Requirements Committee.

5. Using these determinations for each of the metals included in the plan, the WPB Director of Industry Operations directed processing applications that were subject to review by the industry branches concerned. This final review by the industry branches was subject to final determination by the WPB Priorities Bureau.

6. Provision was made for emergency allocations by establishing a reserve for each material.

7. Requirements of small and other users not coming under the plan continued to be handled through regular priority channels. Materials allowances were made for these uses in the Requirements Committee determinations.

In July 1942, PRP became fully operative on a mandatory basis for controlling distribution of copper and other metals. In the evolution of a control system for the flow of materials, PRP acted as a control mechanism coordinated with and superimposed upon the priorities system. Its purpose was to increase effectiveness of the priorities system by reducing to one revised form the multiple separate applications needed for several materials in a 3-month period, and to make possible a closer identification with the end-use of the material covered by ratings.

From its inception PRP was widely criticized. A principal weakness of the plan was its association of quantities of materials input with quantities of dollar output. For example, trying to schedule tons of copper input per million dollars worth of battleships per quarter was almost meaningless. This prevented allotment of specified quantities of materials to particular firms to produce stated quantities of end-products in a specified time.

In September 1942 a concerted effort was made to design a system of strong and effective control of the production and flow of materials.

Controlled Materials Plan, World War II

A preliminary draft of a plan embodying ideas drawn from numerous plans and variations of plans was developed by October 18, 1942, and labeled the Controlled Materials Plan (CMP). Agreement on the fundamentals of the plan among all participating governmental agencies was reached by November 2, 1942. It was to be transitionally operative in the second quarter of 1943; fully, in the third quarter. In its application, the plan was restricted to steel, copper, and aluminum products, the

three most basic and critical materials. Its main purpose was "To make certain that production schedules are adjusted within materials supply so that production requirements are met." This was accomplished by adjusting requirements for critical materials to the supply and making the required kind and quantities of materials available to meet scheduled programs.

Under CMP applications for material, as well as its distribution, were processed through three broad layers of a procedural pyramid. The base layer comprised secondary consumers receiving allotments of controlled materials "From a prime consumer or another secondary consumer." The intermediate and numerically smaller layer included the prime consumers receiving their allotments "From a claimant agency either directly or through the office of such agency." In the apex of the pyramid were the claimant agencies to whom allotments were issued by the Requirements Committee for reissuance to prime consumers. The claimant agencies were: The War and Navy Departments, the Maritime Commission, the Aircraft Scheduling Unit, Lend-Lease Administration, the Board of Economic Warfare, and the War Food Administration. Each of the seven claimant agencies subdivided the products manufactured under its jurisdiction into programs. Each program was defined as a "Plan specifying the total amount of an item or class of items to be provided in a specified period of time." Programs were subdivided into schedules which were plans specifying the total amount of an item or class of items to be produced or used by an individual consumer in a specified period of time.

Bills of materials submitted by claimant agencies show the amounts of materials required for physical incorporation in the production of a given product, including the portion of these materials consumed or converted into scrap during processing. Requirements for respective CMP materials were aggregated for the several programs of each claimant agency by codes. These identified the particular program in which the product would be used, the calendar quarter in which production of the item and for which the material required was scheduled, the claimant agency, and offices within the claimant agency responsible for the program.

Products manufactured under the plan were divided into two broad classes, with special provisions for those used for maintenance, repair, and operating supplies. These two broad classes were identified as class-A products and class-B products. The terms A products and B products were never given complete precision of meaning, except that B products were those included in an official B product list, while A

products were the products containing controlled materials not on that list. Broadly speaking, class-B products were those used in manufacturing other and more comprehensive products. Class-B include, for example, such items as bolts and electric motors, both could be used in manufacturing such A products as an airplane, a truck, or a tank.

A vast amount of energy was expended to make CMP workable for industry as well as Government. Problems in distribution were constantly arising and various regulations were adjusted to correct them. However, there were no drastic departures from the original plan. CMP remained in force through World War II, and Priorities Regulation 32 was issued incorporating the rules contained in the former Priorities Regulation 1 and Controlled Materials Plan Regulation 2 for continuing the basic inventory controls following termination of CMP, September 30, 1945.

Controlled Materials Plan, Korean Conflict

In the fall of 1950 after the outbreak of the Korean conflict the rate of copper consumption had almost reached the peak level attained in World War II. It was evident that some action was necessary if the defense requirements for copper were to be met. To cope with this problem a Copper Division was established in the National Production Authority (NPA), Department of Commerce to control distribution of supply.

Regulatory measures were devised late in 1950. First, on November 29, 1950, NPA Order M-11 was issued, which established rules for placing, accepting, and scheduling rated orders for copper and copper-base alloys. Order M-12, issued at the same time, limited the amount of copper any consumer could use to a percentage of the average rate of consumption prevailing the first six months of 1950; it also limited consumer inventories to 45 days supply. A third order, M-16, was issued 2 weeks later establishing control over distribution of copper scrap and copper-base alloy scrap.

Almost from the time the orders were issued it was recognized that these preliminary steps were inadequate, and a modified version of the Controlled Materials Plan (CMP) to direct the flow of products and materials into essential programs was established in July 1951.

The Requirements Committee of the Copper Division programed the allocation of copper for the third and fourth quarters of 1951. Beginning with the first quarter of 1952, programing became centralized in the Requirements Committee of the Defense Production Administration (DPA), with that committee functioning

as the recipient of stated requirements for Claimant Agencies, NPA Industry Divisions and DPA-NPA reserves for program adjustments. Screening requirements for program recommendations was accomplished by DPA-NPA Requirements Committees meeting with claimant agencies and industry divisions representatives, to discuss and evaluate the proposed requirements and arrive at preliminary program recommendations. These preliminary recommendations were submitted to the Program Adjustment Committee of the Defense Production Administration, which conducted meetings to hear appeals submitted by the claimant agencies and industry divisions and to make necessary adjustments when advisable to the recommended programs. The programs and appeals were then submitted to the Requirements Committee of the DPA. At a meeting in which all claimants were represented, the Requirements Committee, DPA, affirmed or denied the appeals and announced the final program determinations for the quarter.

In all of the conferences and meetings with claimants conducted by the DPA-NPA Requirements Committees, the Program Adjustment Committee, and the Requirements Committee of DPA, either the Directors of the three NPA Controlled Materials Divisions (steel, copper, and aluminum) or their representatives served in a technical staff capacity to the Chairman of the Requirements Committee, DPA, on determinations as to product feasibility with respect to such controlled materials.

PRICE CONTROLS

World War II

On August 12, 1941, Price Schedule 15 issued by the Office of Price Administration (OPA), provided a price ceiling of 12 cents a pound on copper, delivered Connecticut Valley. The 12-cent ceiling applied to electrolytic-grade copper in wirebars or ingot bars delivered in carlots. Lake copper, which had been sold at a slight premium, was placed on the same basis as electrolytic. A top price of 11½ cents a pound, Connecticut Valley, was set for casting copper made by fire refining to a standard of 99.5 percent pure, including silver as copper. The casting-copper ceiling was revised to 11½ cents, f.o.b. refinery, in early September. Premiums ranged from ¾ cent to 2 cents a pound on less than carlots sold by other than refiners or producers.

The price order exempted sales of copper to the Metals Reserve Co. to enable that organization to purchase high-cost copper at higher-than-ceiling prices. Other provisions referred to other kinds, grades, shapes, or forms, to con-

tracts entered into before the order, and to other items.

In January 1942, ceiling prices were revised on less than carlots, effective February 1, to 12½ cents or electrolytic and Lake copper and 12 cents a pound on other fire-refined and casting copper, f.o.b. shipping points. Premiums were no longer permitted on casting copper sold by persons other than a producer or refiner.

Effective June 3, 1946, ceiling prices for copper were increased; the price for electrolytic copper, delivered Connecticut Valley, was raised to 14½ cents, contingent on completion of certain wage agreements. This resulted in a two-price condition. Uncertainty attended the almost month-long interim (July 1-25) in the operation of OPA. The two prices were eliminated August 2 when 14½ cents was established for all sales. All price controls for copper were removed November 10, 1946.

Price Regulation 12, effective July 22, 1941, established maximum prices for brass mill scrap. On August 19, 1941, ceilings were placed on unalloyed copper scrap. Copper-alloy scrap, except for certain grades of brass mill scrap, was free from formal price ceilings until February 27, 1942 (Price Regulation 20, Copper Scrap and Copper Alloy Scrap). An amendment to the brass scrap price schedule on April 17 encouraged refining of copper from yellow brass scrap and eliminated the need for sorting the yellow grades as refinery brass. On May 11 copper-base scrap prices were revised downward, and a license was required for dealers selling to consumers. On August 17, maximum prices for 13 classifications of copper-alloy scrap were reduced to their proper relationship to the basic 12-cent price of electrolytic copper. On December 31, price ceilings were removed from copper-base scrap imported for Metals Reserve Co.

Establishment of specifications and cents-per-pound prices for 16 new grades of copper scrap and copper-alloy scrap, effective March 22, 1943, brought under specific prices the entire field of such material when sold to consumers. Price controls were removed November 10, 1946.

As early as 1941 the Office of Price Administration began to study methods for encouraging production of copper by marginal mines without raising the ceiling price. In late 1941 arrangements were made for Government purchases of copper from three Michigan companies at 1 cent a pound above out-of-pocket costs.

In January 1942 the Metals Reserve Co. was authorized to buy copper produced at other domestic mines and fulfilling certain requirements at 17 cents a pound, 5 cents above the ceiling price. Payments were to be made on production from February 1, 1942, and were to

extend for 2½ years. The payments were to be made only on production above quotas set by the War Production Board and the Office of Price Administration. The plan was inaugurated to stimulate production from either new or high-cost properties, or both. When individual quotas were established the mines falling into preferred classes were found largely to have zero quotas, which entitled the total quantities produced to bonuses. Well-established, large properties were assigned such high quotas that they were entitled to virtually no benefits, and it was necessary, during the year, to revise a number of quotas. In late 1942 and in early 1943 it became desirable to revise downward many more quotas to take care of the generally increased costs of production. In January 1943 the plan was extended to July 31, 1945; later it was extended, first to the end of June 1946, and then to June 30, 1947. On May 1, 1943, it was announced that a special additional premium would be made available to small copper mines that produced less than 2,000 tons of copper in 1942 and required increased revenue to obtain maximum production. Individual cases were to be considered separately, and a special premium was to be paid at a rate to be fixed for each mine on production in excess of a special quota. The Metals Reserve Co. announced that royalty payments on production entitled to premium payments would be paid at ceiling prices only unless the lease specifically instructed otherwise, as it was not the intent of the order to have anyone other than the actual operator participate in the plan. Royalties paid by domestic mine operators for copper, lead, and zinc ores mined from leased properties were frozen by the Office of Price Administration on April 1, 1943, at rates in effect December 31, 1942.

The premiums for less-than-carload lots (l.c.l.) sold by producers and refiners were revised in January 1942, effective February 1. The ceiling prices, l.c.l., were 12½ cents per pound on electrolytic and Lake copper and 12 cents on other fire-refined and casting copper, f.o.b. shipping points. Premiums were no longer permitted on casting copper sold by persons other than a producer or refiner.

In November 1943 it was announced that no applications for special premiums postmarked after December 31, 1943, would be accepted.

Table 88 shows premium-payment data for February 1942 through June 1947. Ceiling-price restrictions on copper ended in November 1946. Immediately thereafter the price rose to a point where the A bonuses were not applicable; that is, the price was higher than the 12-cent ceiling plus a bonus of 5 cents.

Korean Conflict

The Defense Production Act of 1950, which became law in September, provided for expansion of copper output at mines then operating or idle or for maintenance of production that might be lost without such aid. The properties were to receive Government loans, Government purchase contracts, or tax amortization benefits, or combinations of the three types of assistance (table 89). In the years following the outbreak of hostilities in Korea, the Defense Minerals Administration in the Department of Interior, and its successor, the Defense Materials Procurement Agency, in General Services Administration continued efforts to expand output.

In the General Ceiling Price Regulation issued by the Economic Stabilization Agency on January 26, 1951, prices of copper were not to exceed the highest prices received by individual producers between December 19, 1950, and January 25, 1951, inclusive. Primary producers in general had been selling electrolytic copper, delivered Connecticut Valley, at 24½ cents a pound; this figure became the ceiling price. There were, however, companies whose ceiling prices substantially exceeded the 24½-cent price. The quantities to which higher ceilings applied were relatively small.

In May 1951 an agreement between the United States and Chilean Governments provided for payment of 3 cents a pound more than the ceiling price for Chilean copper sold in the United States. The agreement provided for expansion in production by Chile and for discontinuance of abnormal trade in semiprocessed copper by Chile. Chile was not to withhold more than 20 percent of production of U.S. companies operating in Chile. It also provided for a Chilean embargo on exporting copper to countries of the Soviet bloc.

The Office of Price Stabilization (OPS) announced that, effective July 25, 1951, the ceiling price for copper refined in the United States from imported crude materials would be 27½ cents a pound, delivered Connecticut Valley. The increased cost of foreign copper was not to be passed on to customers by the fabricators.

In May 1952 Chile abrogated the agreement because of its dissatisfaction with the 27½-cent price. Exports to the United States were embargoed for a short time; but on May 21 the Office of Defense Mobilization (ODM) authorized importers to pay higher prices for imported copper and to pass on to consumers 80 percent of costs greater than 27½ cents. This was revised in early June to the increase over 24½ cents. Shipments of Chilean copper to the United States were resumed. On June

TABLE 88.—Salient statistics covering bonus payments ¹ of the Government, 1942-47

	1942, February-December		1943		1944		1945		1946		1947, January-June		1942-47	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Production:														
At ceiling price.....	881,711	89.23	841,286	77.12	722,791	74.53	561,851	72.57	392,828	65.22	389,156	90.39	3,789,623	78.04
At overceiling prices:														
Under premium price plan:														
A quota only, 17 cents a pound.....	102,352	10.36	217,382	19.93	194,483	20.06	179,389	23.17	² 98,219	² 16.31	41,391	9.61	1,066,212	21.96
Special, 17.01-27 cents a pound.....	716	.07	14,003	1.28	26,168	2.70	22,917	2.96	² 87,060 ² 24,248	² 14.45 ² 4.02				
Metals Reserve mine contracts.....	103,068 ⁴ 8,315	10.43 .34	231,385 18,147	21.21 1.67	220,651 26,347	22.76 2.71	202,306 10,075	26.13 1.30	209,527	34.78				
Total overceiling production.....	106,383	10.77	249,532	22.88	246,998	25.47	212,381	27.43	209,527	34.78	41,391	9.61	1,066,212	21.96
Total production ⁵	988,094	100.00	1,090,818	100.00	969,789	100.00	774,232	100.00	602,355	100.00	430,547	100.00	4,855,835	100.00
	Total	Price per pound, cents	Total	Price per pound, cents	Total	Price per pound, cents	Total	Price per pound, cents	Total	Price per pound, cents	Total	Price per pound, cents	Total	Price per pound, cents
Payments:														
Under premium price plan:														
A quota only.....	\$10,306,829	17.00	\$23,138,490	17.00	\$22,065,137	17.00	\$20,230,618	17.00	² \$13,684,190	² 19.59	\$2,148,937	23.16	\$118,860,342	(6)
Special.....	20,623	18.44	1,735,266	23.20	3,450,898	23.59	3,198,357	23.98	² 7,270,723 ² 1,559,173	² 21.18 ² 22.39				
Metals Reserve mine contracts.....	10,327,452 ⁴ 188,117	17.01 14.84	24,873,756 3,488,489	17.38 21.61	25,516,035 4,258,562	17.78 20.08	23,428,975 2,115,933	17.79 22.50	22,514,086	19.24				
Total overceiling payments.....	10,515,569	16.94	28,362,245	17.68	29,774,597	18.03	25,544,908	18.01	22,514,086	19.24	2,148,937	23.16	118,860,342	(6)
Total U.S. production.....		12.25		13.30		13.54		13.65		15.70		21.25		(6)

¹ From published and unpublished reports of the Office of Price Administration and the Office of Premium Price Plan for Copper, Lead, and Zinc. Excludes exploration premiums totaling \$6,213,545 paid for July 1, 1946, through December 31, 1947, to encourage exploration and development of copper, lead, and zinc deposits; this total cannot be broken down by metals.

² January-October. A and Special quotas and premium payments for November and December are not separable and are shown with footnote 3.

³ Total A and Special quotas and premium payments for November and December; separation by kinds not available.

⁴ Treasury Procurement Division contracts in 1942.

⁵ From monthly reports of Bureau of Mines; do not exactly check final annual totals for the United States except for 1943.

⁶ Not reported.

STRATEGIC FACTORS

TABLE 89.—*Contracts for expansion and maintenance of supply of copper under Defense Production Act of 1950*

Type of contract or assistance, name of contractor, and location of project	Quantities involved (pounds)		Effective date of contract	Date production started	Approximate term of contract	Commitment purchase price (per pound)
	Total	Contingent purchase commitments ¹				
Floor price:						
American Smelting & Refining Co., Silver Bell mine, Pima County, Ariz.....	197,000,000	177,000,000	Nov. 28, 1951..	Not later than Nov. 28, 1953.	7½ years.....	\$0.245 or market. ²
Anaconda Copper Mining Co., Yerington, Lyon County, Nev.....	384,000,000	256,000,000	Nov. 10, 1951..	Not later than Dec. 6, 1953.	8 years.....	0.255 or market. ^{2,3}
Calumet & Hecla Consolidated Copper Co., Osceola mine, Houghton County, Mich.....	106,000,000	106,000,000	July 18, 1952..	July 1, 1955.....	10 years.....	0.2525. ^{2,3}
Copper Cities Mining Co., Copper Cities, Gila County, Ariz.....	192,500,000	170,000,000	Sept. 24, 1951..	Apr. 1, 1955.....	8½ years.....	0.230. ²
Phelps Dodge Corp., Bisbee East ore body, Cochise County, Ariz.....	300,000,000	225,000,000	do.....	Not later than Sept. 24, 1955.	8 years.....	0.220. ²
White Pine Copper Co., White Pine mine, Ontonagon County, Mich.....	550,000,000	487,500,000	Feb. 28, 1952..	Not later than Feb. 26, 1955.	9¾ years.....	0.255. ^{2,3}
Campbell Chibougamau Mines, Ltd., Merrill Island, Dore Lake, Quebec, Canada.....	63,200,000	63,200,000	June 10, 1952..	Not later than Dec. 10, 1954.	4½ years.....	0.245. ²
San Manuel Copper Corp., Pinal County, Ariz.....	730,000,000	695,000,000	Aug. 29, 1952..	Not later than Feb. 29, 1957.	10 years.....	0.24. ²
Bagdad Copper Corp., Yavapai County, Ariz. ⁴	216,000,000	216,000,000	Oct. 16, 1952..	Oct. 15, 1952.....	do.....	0.245. ²
Subsidy: ⁵						
Banner Mining Co., Miser's Chest mine, Hidalgo County, N. Mex.....	5,400,000	-----	Mar. 3, 1952..	Dec. 1, 1951.....	2 years.....	None. ³
Calumet & Hecla Consolidated Copper Co., three mines in Houghton and Keweenaw Counties, Mich. ⁷	14,780,000	-----	Jan. 8, 1952..	do.....	12-17 months.....	Do. ³
Copper Range Co., Champion No. 4 east ore body, Houghton County, Mich.....	6,372,000	-----	Mar. 13, 1952..	Jan. 1, 1952.....	2 years.....	Do. ³
Howe Sound Co., Holden mine, Chelan County, Wash.....	8,394,000	-----	June 12, 1952..	Feb. 1, 1952.....	1 year.....	Do. ³
Sam Knight Mining Lease, Inc., Christmas mine, Gila County, Ariz.....	2,390,000	-----	Mar. 14, 1952..	Dec. 1, 1951.....	2 years.....	Do. ³
Yucca Mining & Milling Co., Inc., Antler mine, Mohave County, Ariz.....	5,205,000	-----	Apr. 10, 1952..	do.....	3 years.....	Do. ³
Maintenance of production:						
Copper Range Co., Champion mine, Houghton County, Mich.....	-----	7,965,000	Aug. 12, 1953..	July 1, 1953.....	2½ years.....	0.32.
Riviera Mines Co., Christmas mine, Gila County, Ariz.....	-----	8,000,000	Sept. 28, 1953..	Not later than Oct. 15, 1953.	2¼ years.....	0.32.
Howe Sound Co., Holden mine, Chelan County, Wash.....	-----	18,700,000	Nov. 8, 1953..	Sept. 1, 1953.....	2½ years.....	0.315.
Appalachian Sulphides, Inc., Orange County, Vermont.....	-----	4,000,000	Mar. 19, 1954..	July 1, 1954.....	1½ years.....	0.3106.
Purchase:						
National Lead Co., ⁸ Madison County, Mo.....	-----	7,200,000	Dec. 1, 1956 ¹⁰	Apr. 1, 1953.....	6 years.....	0.36.
Falconbridge Nickel Mines, Ltd., McKim and Hardy mines, Ontario, Canada ¹¹	25,000,000	25,000,000	Feb. 14, 1952..	Jan. 1, 1952.....	10 years.....	0.19 or market. ³
Miami Copper Co., Miami mine, Gila County, Ariz.....	-----	120,000,000	Feb. 13, 1953..	Not later than June 30, 1955 ¹²	8-8½ years.....	0.2735. ^{3, 13}
Banner Mining Co., Mineral Hill and Plumed Knight mines, Pima County, Ariz.....	-----	12,960,000	May 25, 1953..	May 1, 1954.....	8 years.....	0.31. ¹⁴
Copper Creek Cons. Mining Co., Old Reliable mine, Pinal County, Ariz.....	-----	5,500,000	June 17, 1953..	Dec 31, 1954.....	3 years.....	0.29.
International Nickel Co. of Canada, Ltd., Sudbury district, Ontario, Canada ¹⁵	-----	100,000,000	May 29, 1953..	June 1, 1953.....	5 years, 7 months.....	0.27. ²
Falconbridge Nickel Mines, Ltd., Ontario, Canada ¹⁶	-----	32,000,000	Mar. 27, 1953..	Dec. 31, 1953.....	3 years.....	0.275-0.30.
Advance-repayment:						
North Butte Mining Co., Granite Mountain mine, Silver Bow County, Mont.....	5,250,000	-----	Sept. 19, 1951..	Dec. 1951.....	21 months.....	(¹⁷).
Banner Mining Co., Mineral Hill and Plumed Knight mines, Pima County, Ariz.....	-----	12,960,000	May 26, 1953..	May 1, 1954.....	3 years.....	(¹⁸).

Type of contract or assistance, name of contractor and location of project	Approximate amount involved	Date loan approved or certificate of necessity issued
Loan:		
White Pine Copper Co., White Pine mine, Ontonagon County, Mich.	\$57,185,000	Nov. 15, 1951
San Manuel Copper Co., Pinal County, Ariz.	94,000,000	July 10, 1952
Yucca Mining & Milling Co., Antler mine, Mohave County, Ariz.	50,000	Oct. 30, 1952
Campbell-Chibougamau Mines, Ltd., Merrill Island, Dore Lake, Quebec, Canada	5,600,000	May 18, 1953
Rhodesia Congo Border Power, Ltd., Northern Rhodesia	22,400,000	June 17, 1953
Tax amortization:¹⁹		
American Smelting & Refining Co., Silver Bell mine, Pima County, Ariz.	11,555,000	Jan. 4, 1952
Anaconda Copper Mining Co., Yerington mine, Lyon County, Nev.	24,685,000	Oct. 15, 1951
Phelps Dodge Corp., Bisbee, East ore body, Cochise County, Ariz.	12,401,000	July 6, 1951
White Pine Copper Co., White Pine mine, Ontonagon County, Mich.	40,912,000	Nov. 16, 1951
C. L. Maguire, Unida Copper, Yavapai County, Ariz.	76,000	June 15, 1951
Kennecott Copper Corp.:		
Deep Ruth mine, White Pine County, Nev.	3,988,000	Apr. 4, 1951
Utah mine, Salt Lake County, Utah	3,330,000	May 20, 1952
Do.	1,374,000	July 31, 1952
Do.	1,946,000	July 6, 1951
Do.	670,000	Aug. 3, 1951
Sierra Copper Co., Calaveras County, Calif.	27,000	Oct. 8, 1951
Allied Chemical & Dye Co., Grayson County, Va.	561,000	Feb. 7, 1952
San Manuel Copper Co., Pinal County, Ariz.	64,691,000	Dec. 19, 1952
Anaconda Copper Mining Co., Greater Butte project, Silver Bow County, Mont.	3,939,000	May 21, 1952
Bagdad Copper Corp., Yavapai County, Ariz.	11,134,000	July 15, 1952
Banner Mining Co., Pima County, Ariz.	790,000	Apr. 29, 1953
Copper Creek Consolidated Mining Co., Pinal County, Ariz.	245,000	Apr. 21, 1953
U.S. Metals Refining Co., Carteret, N.J.	68,000	June 8, 1954
Pima Mining Co., Pima County, Ariz.	8,873,000	Sept. 29, 1955
Inspiration Consolidated Copper Co., Gila County, Ariz.	²⁰ 6,824,805	Sept. 15, 1955
The Anaconda Company, Greater Butte, Mont.	3,963,000	Oct. 28, 1955
Inspiration Consolidated Copper Co., Inspiration, Ariz.	8,505,000	Mar. 15, 1956

¹ Some contracts provided for larger production which could be sold to other producers.

² Includes escalator clause.

³ Contracted at over ceiling price—ceiling price was 24½ cents a pound for most producers.

⁴ Also 30,660,000 pounds out of 32,120,000 pounds of molybdenum at \$0.60 per pound.

⁵ Also 3,760 short tons of molybdenum.

⁶ All subsidy contracts were automatically terminated February 25, 1953.

⁷ Original contract covered four mines, but contract was amended August 11, 1952, to include only three mines.

⁸ Original contract provided for 12 million pounds.

⁹ Also 9,240,000 pounds of nickel and 7,320,000 pounds of cobalt.

¹⁰ Replaces original contract effective October 11, 1951. Production was scheduled to start April 11, 1953, and was subsequently extended to February 11, 1954.

¹¹ Also 75,000,000 pounds of nickel, of which 25,000,000 is at contractor's option, and 1,500,000 pounds of cobalt.

¹² Date reflects beginning of term of production.

¹³ Government purchase obligation for part of molybdenite production at floor price—\$1.00 per pound of contained Mo—but option to purchase all of it at market price.

¹⁴ Option to purchase all or part of molybdenite production at market price.

¹⁵ Also 120 million pounds of nickel.

¹⁶ Also contractors option to deliver an additional 20 million pounds of copper; and 150 million pounds of nickel, of which 50 million pounds is deliverable at contractors option, and approximately 2 million pounds of cobalt.

¹⁷ Terms of repayment of \$60,000 loan were 1 cent a pound on first 300,000 pounds of contained copper and 2 cents thereafter, until repaid with interest, but not later than June 30, 1953.

¹⁸ Terms of repayment of \$430,565 were 17½ cents per pound of refined copper plus interest, until \$43,100 has been paid, and 3½ cents per pound of refined copper thereafter with interest. Repayment to be made by or before 4½ years from date of contract.

¹⁹ Amortization—5 years at 75 percent of total amount involved.

²⁰ Original contract provided for \$3,600,000.

24, OPS exempted from price control in Amendment 21 to GOR-9 imported refined copper and copper refined from imported copper-bearing materials and scrap purchased after June 16. Amendment 23 extended the exemption to such copper imported between May 8 and June 16. Amendments were issued to orders for wire mills and brass mills, effective July 1, to reflect increases permitted by the ODM directive. Ceilings were revised from time to time, based partly on the proportion of foreign to domestic copper available.

To make as equitable a distribution as possible of the different-priced supplies, NPA allocated copper to all consumers on the basis of estimated supply—60 percent domestic and 40 percent foreign. Prices of products were based on this assumed distribution until the end of 1952.

Ceiling prices on brass and bronze ingots were established on February 27, 1952, by OPS order CPR-127, effective March 3. The regulation gave specific ceiling prices for carlots of all the listed alloys of brass and bronze ingot normally produced, and made provision for transportation costs and shipments of less-than-carload lots. Under the General Ceiling Price Regulation (GCPR) there were diverse selling prices for these products.

Effective March 12, Amendment 2 to order CPR-46 established ceilings on dealer-to-dealer sales that were identical to those previously provided for other persons. In addition, payment was permitted of a maximum premium of 1.75 cents a pound on sales between dealers.

On June 30 the OPS issued, effective July 1, Amendments 1 to CPR-68 and CPR-110 on brass mill products and wire mill products respectively—establishing higher prices for these products, based on passing on to consumers 80 percent of increased costs of imported copper that were more than 24½ cents a pound. The increases usually amounted to 3.84 cents a pound for brass-mill products, and allowing for scrap loss and insulation, 3.25 cents for weatherproof wire.

On August 14, Amendment 7 to CPR-60 permitted copper and copper-alloy castings producers to pass on increased costs from use of foreign copper.

Special Regulation 125 to GCPR, effective November 24, permitted producers of products in which primary copper was used, and whose ceiling prices were established under GCPR, to adjust their ceiling prices for these products to reflect the increased cost of foreign copper.

On February 13, 1953, OPS removed price controls on nonferrous scrap, and on February

25 controls were abandoned on primary copper and copper products.

STOCKPILING

Strategic Materials Act of 1939

The Strategic Materials Act of June 7, 1939 (Public Law 117), provided the first authority for Government stockpiling. In this act the Congress authorized expenditure of \$100 million to purchase, move, and store stocks of strategic and critical materials, and an immediate appropriation of \$10 million was made for that purpose. Additional appropriations of \$12.5 million and \$47.5 million were made in March and June 1940, respectively, bringing the total available for stockpiling to \$70 million. The terms of the act required advertised bidding, prohibited negotiations, and allowed as much as a year for production and delivery.

Reconstruction Finance Corporation Act of 1933, Amended

The urgency of the international situation demanded faster action than that available under the Strategic Materials Act, and on June 25, 1940, the Reconstruction Finance Corporation Act of 1933 was amended to permit establishment of subsidiary corporations, having power to produce, procure, and store strategic and critical materials and to make loans for such purposes. Under this amendment the Metals Reserve Co. was created on June 28, 1940.

Toward the end of 1940 a shortage of copper developed, and the Metals Reserve Co. began making arrangements to purchase Latin American copper. Receipts were to form a buffer stockpile, and manufacturers that were unable to obtain their copper requirements from domestic refiners were permitted to draw from Government stocks. By April 30, 1941, Metals Reserve Co. had arranged to buy 500,499 tons of copper. Deliveries from the stockpile to consumers began in March 1941. At the beginning of 1946, Metals Reserve had nearly 600,000 tons of refined and unrefined copper for allocation, but by the end of the year this supply had been reduced to 92,758 tons, and on December 31, 1947, there was only 9,986 tons in inventory.

Surplus Property Act

Early in the third quarter of 1944 it seemed possible that the European phase of the war would end, and it appeared that a surplus of copper would develop which would have an

adverse effect on the industry. The Surplus Property Act was passed, effective October 3, 1944, to prevent excess materials from reaching markets. The act provided that all Government-owned accumulations of certain strategic minerals and metals (including scrap), when determined to be surplus, should be added to the permanent stockpile authorized by the Strategic Materials Act of 1939. This action would prevent flooding the postwar markets with Government inventories. In effect, it froze the entire Government stocks of copper that would be on hand at the end of the war.

A postwar surplus of copper did not develop. Domestic production was far short of expectations as the result of a difficult labor situation. With the postwar increase in demand, the Government stocks prevented a serious copper shortage. Most of the Office of Metals Reserve (formerly Metals Reserve Co.) stock of copper was released to industry, and the balance was transferred to the Strategic Stockpile.

Strategic and Critical Materials Stockpiling Act of 1946

Congress enacted the Strategic and Critical Materials Stockpiling Act of 1946 (Public Law 76-117, 1939; Public Law 79-520, July 23, 1946, Rev.) in order to provide for acquisition and retention of stocks of strategic and critical materials and to encourage conservation and development of sources of these materials within the United States; thereby decreasing and preventing whenever possible a dangerous and costly dependence of the United States upon foreign nations for supplies of these materials in times of national emergency. The passage of this act reaffirmed the will of the Government to pursue a stockpiling program on a scale adequate for national defense.

Administration of Stockpile Act.—The Act of 1946 placed responsibility on the Secretaries of War, Navy, and Interior for determining what materials and what quantities of each should be stockpiled. Stockpiling functions assigned to the Secretaries of the Army, Navy, and Air Force were delegated December 19, 1947, with concurrence of the Secretary of Defense, to the Munitions Board. To facilitate maintenance of a proper relationship between the national economic and military interest, the Munitions Board constantly advised the National Security Resources Board of stockpiling plans and operations. (Under the National Security Act, approved August 5, 1947, the Munitions Board was instructed—Section 213-3-(8) "To maintain liaison with other departments and agencies for the proper correlation of military requirements with the civilian economy, particularly in regard to the procurement or

disposition of strategic and critical material, and to make recommendations as to policies in connection therewith.") Purchasing, storage, and rotation, directed by the Munitions Board, were functions of the Bureau of Federal Supply of the Treasury Department.

The Federal Property and Administrative Services Act of 1949, as amended, transferred to the General Services Administration the functions of the Bureau of Federal Supply of the Department of the Treasury, including its functions, under the Strategic and Critical Materials Stockpiling Act. The Emergency Service was established by the Administrator of GSA on September 1, 1950, to administer these stockpiling functions. This organization was renamed the Defense Materials Service on September 7, 1956.

Reorganization Plan Number 3 of 1953 reorganized, among other things, various activities relating to stockpiling strategic and critical materials. Subsection 2(b) of the Plan transferred to the Director, Office of Defense Mobilization, all functions under the Stockpiling Act vested in the Secretaries of the Army, Navy, Air Force, and Interior or in any of them or in any combination of them, including the functions which were assigned to the Army and Navy Munitions Board, but excluding the functions vested in the Secretary of the Interior by Section 7 of the said act with respect to investigations of domestic ores and minerals. In July 1958, all functions under the Strategic and Critical Materials Stockpiling Act, as amended, were redelegated by Executive Order to the Office of Civil and Defense Mobilization in the Executive Office of the President pursuant to Reorganization Plan 1 of 1958. Another reorganization in 1961 placed the administration of all stockpiling under the Office of Emergency Planning in the Executive Office of the President.

Other Government Stockpiles.—Three other Government stockpiles or inventories, in addition to the strategic or national stockpile were authorized by specific legislation. The Defense Production Act of 1950 authorized the Government to encourage expansion of productive capacity and supply by purchasing materials for Government use or resale. The reserve thus accumulated is referred to as the DPA inventory or stockpile. The supplemental stockpile was authorized by the Agricultural Trade Development and Assistance Act of 1954 (Public Law 83-480, 1954), and materials acquired by the Department of Agriculture in exchange for surplus agricultural commodities that deteriorate and are costly to store are placed in this inventory. Some of the materials are being held against strategic stockpile objectives, but most of the material

is additional to the strategic stockpile. Then there is the CCC (Commodity Credit Corporation) inventory acquired by the Department of Agriculture by barter of surplus agricultural commodities under several statutes. If there is no other Government use for the materials, they are required by law to be transferred to the supplemental stockpile.

Copper Stockpile.—The projected accumulation of a strategic stockpile of copper under the Strategic and Critical Materials Stockpiling Act made little progress from approval of the Act July 23, 1946, through June 30, 1948, because of a provision that industrial reconversion must not be retarded by diversion of supplies to the stockpile. The objective, established at 1,250,000 tons of copper, was scheduled for completion by June 30, 1951, but at mid-1948, the inventory amounted to only 6,300 tons, most had been obtained from postwar surplus transfers (5,200 tons). However, in the next three years almost 600,000 tons of copper was acquired. The objective was raised to 2.1 million tons in 1950, then lowered to 1.1 million in 1952.

In 1954, ODM rulings called for the establishment of two types of objectives: (1) Basic objectives, which assume partial dependence during an emergency on imports from areas beyond North America; and (b) maximum objectives, which provide a higher degree of security by completely discounting emergency supply from distant overseas sources. (Between 1954 and 1958 there were two objectives for metals and minerals; before 1954 there was only one objective for each material.) The basic objective for copper was raised to 1.6 million tons in 1954, and the maximum objective was set at 3.5 million tons. These goals were maintained through 1957. The basic and maximum objectives were reduced tentatively to 860,000 tons and 1,900,000 tons, respectively, in 1958 and to zero tons and 1 million tons in 1959, where they remained through 1961.

The strategic stockpile had accumulated more than 855,000 tons by the end of 1954, and in that year about 4,300 tons was purchased with Defense Production Act funds. Some copper was procured through barter by the Commodity Credit Corporation from 1957 through 1961, and acquisitions for the supplemental stockpile were made from 1959 through 1961. The status of the Government stocks

of copper as of December 31, 1961, was as follows:

	Million dollars	Thousands of short tons
Basic objective.....	-----	0
Maximum objective.....	-----	1,000
National stockpile.....	-----	1,009
DPA inventory.....	-----	122
CCC and supplemental stockpile.....	-----	11
Total.....	-----	1,142
Acquisition cost.....	\$596.6	-----
Market value (Dec. 31, 1961).....	710.9	-----
Excess over maximum objective.....	-----	142,000
Value (Dec. 31, 1961).....	88.0	-----

Included in Government stocks were 21,066 tons of oxygen-free, high-conductivity copper in the national and 5,199 tons in the supplemental stockpiles.

PREPAREDNESS PROGRAMS

When the Korean conflict ended, the need was recognized for improving our preparedness position as to industrial mobilization to meet any future emergency. Renewal of the Defense Production Act in 1953 reflected the concern of both the Congress and the executive branch of the Government for achieving a continuing state of readiness for effective mobilization, resulting from the unsettled world situation.

The Office of Emergency Planning in the Executive Office of the President recommends Executive Orders designed to develop defense-mobilization plans and programs by several departments and agencies of the executive branch of the Government to meet all conditions of national emergency, including attack on the United States.

The Office of Minerals Mobilization, under supervision of the Assistant Secretary of the Interior-Mineral Resources, carries out functions authorized by the Defense Production Act, as amended, and delegated to the Secretary of the Interior by Executive Order and by orders of the Office of Emergency Planning with respect to strategic and critical metals and minerals. The Office is concerned with the adequacy of the supplies of certain metals and minerals and facilities to fulfill both civilian and military requirements under partial and full mobilization.

The Business and Defense Services Administration (BDSA) in the Department of Commerce carries out the industrial defense mobilization planning responsibilities of the Department under the general guidance of the Office of Emergency Planning. The major mobilization planning programs include developing and administering systems for scheduling and controlling production and distribution of materials and products during an emergency. Such a system has been developed by BDSA and is known as the Defense Materials System (DMS), which is basically similar to the Controlled Materials Plan administered during both World War II and the Korean conflict.

The Defense Materials System (DMS) is a body of Government regulations, orders, and procedures issued under the authority of the Defense Production Act. The priorities provided under DMS were being used in 1962 despite a relatively easy supply situation with respect to most materials and products needed in defense programs. Examples of such programs are: Missiles systems, space programs, atomic energy developments, and equipment needed to maintain the combat readiness of the military forces. Operation of DMS results in maintenance of an administrative means of promptly mobilizing the total economic resources of the United States in the event of war.

The Defense Materials Service in General Services Administration is responsible for acquisition of strategic and critical materials for the national stockpile, for expansion and or maintenance of production of industrial raw materials including domestic purchase programs, and for the qualitative maintenance and management of strategic and critical materials in the national stockpile and the other Government inventories of industrial raw materials.

SELF SUFFICIENCY

Before 1940 the United States was a net exporter of copper. Since that time, because of World War II and postwar demands, a substantial portion of the copper supply of the Nation has been imported except for the years 1958, 1960, and 1961. The largest quantities were imported during World War II, the peak year being 1945 when net imports reached 721,000 tons (table 90). From 1946 through

1956 copper in unmanufactured forms received from foreign sources ranged from 200,000 to 500,000 tons per year. In 1957 and 1958, demand and imports decreased. A prolonged strike in 1959 caused a substantial loss of domestic production and created the need for a larger quantity of net imports. In 1960 imports and exports were almost equal, and in 1961 the United States again became a net exporter.

For the short term, the U.S. position with respect to an adequate supply of copper is satisfactory. This outlook is supported by an estimated annual mine production capacity of 1.5 million tons of copper, an annual availability from secondary sources (old scrap only) of 450,000 tons, and a reserve of 1,142,000 tons of copper in the national stockpile. Furthermore, expansion of copper production in Canada, Chile, and Peru provide sample sources of imports in the Western Hemisphere.

TABLE 90.—*Import and export balance, 1939-61, short tons*

Year	Imports of unmanufactured copper	Exports of metallic copper	Net imports (+) or exports (-)
1939.....	336, 297	427, 517	+ 91, 000
1940.....	491, 342	427, 650	- 63, 000
1941.....	735, 545	158, 893	- 576, 000
1942.....	764, 393	210, 518	- 554, 000
1943.....	716, 596	294, 459	- 422, 000
1944.....	785, 211	237, 515	- 548, 000
1945.....	853, 196	132, 545	- 721, 000
1946.....	396, 380	97, 475	- 299, 000
1947.....	413, 890	196, 999	- 217, 000
1948.....	507, 449	207, 022	- 300, 000
1949.....	552, 709	195, 990	- 357, 000
1950.....	690, 389	192, 339	- 498, 000
1951.....	489, 135	166, 274	- 323, 000
1952.....	618, 880	212, 390	- 406, 000
1953.....	676, 104	171, 393	- 505, 000
1954.....	594, 829	312, 433	- 282, 000
1955.....	594, 100	259, 942	- 334, 000
1956.....	595, 747	280, 575	- 315, 000
1957.....	594, 032	430, 446	- 164, 000
1958.....	496, 301	428, 015	- 68, 000
1959.....	570, 891	196, 012	- 374, 000
1960.....	524, 357	512, 332	- 12, 000
1961.....	458, 690	498, 198	+ 39, 508

Source: Sallent Statistics Tables, Minerals Yearbooks, Bureau of Mines.

BIBLIOGRAPHY

- Bureau of Demobilization, Civilian Production Administration. Industrial Mobilization For War. History of the War Production Board and Predecessor Agencies 1940-45, 1947, 1010 pp.
- Kinzie, George R. Copper Policies of the War Production Board and Predecessor Agencies, May 1940 to November 1945. Historical Rept. on War Administration, War Production Board, Special Study No. 29, Civilian Production Administration, Bureau of Demobilization, April 26, 1947, 196 pp.
- Lasky, S. G. Economics, Foreign Pressures, Depleted Mines—Determine Mineral Self-Sufficiency. Min. Eng., v. 13, No. 8, August 1961, pp. 971-973.
- Morgan, John Davis, Jr. The Domestic Mining Industry of the United States in World War II. National Security Resources Board, 1949, 500 pp.
- Morgan, John D., Jr. U.S. Strategic Materials Stockpiles and National Security. Min. Eng., v. 12, No. 8, August 1960, pp. 925-928.
- National Production Authority, U.S. Department of Commerce. Copper, History of the Copper Division of the National Production Authority. Historical Rept. on Defense Production, Rept. No. 27, June 15, 1953, 150 pp.
- Pehrson, Elmer W. Minerals in National and International Affairs. Ch. 11 in Econ. of the Min. Ind., A.I.M.E., New York, 1959, pp. 497-544.
- U.S. Business and Defense Services Administration, Department of Commerce. The Defense Materials System and Priorities. 1961, 52 pp.
- U.S. Office of Emergency Planning, Executive Office of the President. A Review of U.S. Stockpiling, 1921-61, Press Release 35; The Strategic Stockpile and Other Government Inventories of Strategic Materials, Press Release 36; Stockpiling Procedures and Policies Relative to the National Stockpiles, Press Release 37; and Description Data Strategic and Critical Materials in Stockpile Press Kit. March 1962.
- U.S. Office of the Federal Register, National Archives and Records Service, General Services Administration. United States Government Organization Manual, 1961-62, 821 pp.